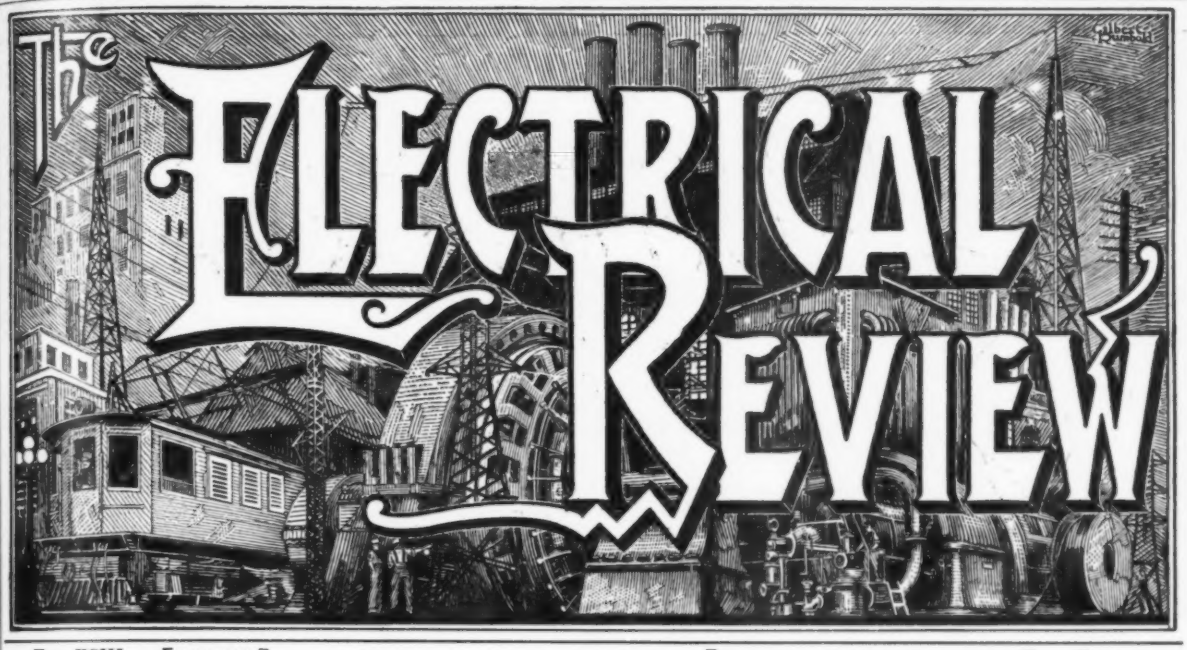
UNIV. OF MICH. DEC 11 1923



Vol. XCIII. No. 2401. [All Rights Reserved.] NOVEMBER 30, 1923. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE SIXPENCE.

LITHOLITE INSULATORS, Ltd.
55–57, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 592, London.
FIREPROOF AND OTHER GRADES.
WIRELESS MOULDINGS.

The Acme Production Co., Ltd., Electrical Specialities Manufacturers. — Britannia Works, Rolfe St. and Engine St., SMETHWICK, BIRMINGHAM.
Automatic Flashers

WRIGHT Tel.: Motor.
A.C. and D.C. **MOTORS.**
WRIGHT MOTORS, Ltd., HALIFAX.

LANTERN REFLECTOR, WATERTIGHT AND SHIPS' FITTINGS.
E.L.E.C., LTD.
with Anti-Vibrator Discs.
ENGINEERING & LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans, Herts.

SURGE ARRESTERS AND—
See next announcement.
ISENTHAL & CO., LTD.,
Denzil Works, Willesden, N.W. 10.

SWITCHGEAR.
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON.

MICA & MICANITE
TAYLOR & PETTERS, LTD.,
40, Hatton Garden, London, E.C. 1.
'Phone: 4575 Central. See p. ii.

ALUMINIUM—STEEL
FOR
LONG-SPAN TRANSMISSION.
The British Aluminium Co., Ltd.
109, Queen Victoria St., London.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

ELECTRIC MOTOR REPAIRS.
ARMATURES REWOUND.
H. DUNN & SON,
Newington Causeway,
Tel.: Hop. 1167. LONDON, S.E. 1.

"EMPIRE"
AUTOMATIC CONTROL
for
PUMPS, COMPRESSORS, MACHINE TOOLS
ELECTRIC CONTROL, LTD., GLASGOW.
Birmingham, Leeds, London, Manchester.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Connaught House, Aldwych, W.C. 2.
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement this week, p. xvi.

A. MARTELLI
6, Little Newport St., Charing Cross Rd., W.C. 2.
LARGEST STOCK in the World of Italian
ALABASTER BOWLS.
Carved Bowls and Brown-Veined Plain Bowls at only 25% more than Plain Grey-Veined.
ASK FOR BEAUTIFULLY ILLUSTRATED PRICE LIST.
Gerrard 2901 *Cables: "Agatina, London."*

WHITE
Electrical Instrument Co., Ltd.
2, 4 & 6, GLOUCESTER ST., CLERKENWELL, LONDON, E.C. 1.
Wire, Voltograph, London. 'Phone: City, 8660.

ELECTRIC MOTORS.
One, Two and Three-Phase.
BRITTAIN'S ELECTRIC MOTOR CO.
(Late Langdon-Davies Electric Motor Co.),
110, Cannon Street, London, E.C. 4.

INSULATING
- - BEADS - -
Immediate Delivery.
HOLDER-HARRIDEN LTD., 1-2, Chiswell St., London, E.C.

Free Trade for ever!
Protection the panacea!
See Sup. 8 and 9.

DERMATINE
JOINTING
PUMP VALVES
HOSE & TUBING
BELTING
Dermatine Co., Ltd., Neate St., London, S.E. 5.

SHUNT REGULATORS.
MOTOR STARTERS and all classes of Resistance Work.
STAR DELTA SWITCHES.
THE SOLENOID REGULATOR CO.,
HIGHGATE SQUARE, CAMP HILL,
Telephone: Midland 593 **BIRMINGHAM.** Telegrams: Solenoid, Birmingham.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

CONVEYORS & ELEVATORS.
Power Station, Coal & Ash Handling Plants.
FRASER & CHALMERS ENGINEERING WORKS,
(*Proprietors*: The General Electric Co., Ltd.)
ERITH, KENT. *London Office:* Magnet House, Kingsway, W.C. 2.
Associated with Robins Conveying Belt Co., of U.S.A.

CARSON'S
27, UPPER THAMES ST., E.C. 4.
'Grams: "Irishism Cent. London." 'Phone: Central 3997.
INSULATORS.
See p. xxii.

FULLER'S UNITED ELECTRIC WORKS, LIMITED.
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES EBONITE
WIRELESS APPARATUS CARBON BLACK
Head Office:
(*General Sales Offices and Works*).
WOODLAND WORKS, GROVE ROAD,
CHADWELL HEATH, ESSEX.

INGLEBY & Co., Ltd.
BEESTON,
LEEDS.
ELECTRIC MOTORS.

Advertisement Index, see page xl. *Official Notices, see Sup. 42.*

Don't forget your additional Salesman

"FATHER XMAS!"

Every live Electrical Contractor should have his stocks ready with

Hotpoint

APPLIANCES

The discriminating buyer of Electrical Apparatus insists upon "Hotpoint"——

SEE THAT YOUR STOCKS ARE READY!

The Hotpoint Electric Appliance Co., Ltd.,

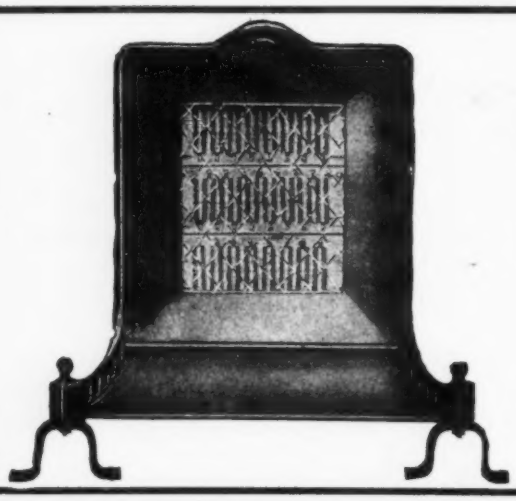
21, Berners St., LONDON, W. 1,
18, Queen St., MANCHESTER,
32, Bothwell St., GLASGOW.

MICA & MICANITE

INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE—4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON."

TAYLOR & PETTERS, LTD.,
40, HATTON GARDEN,
LONDON, E.C. 1.
(The Oldest Established Mica House in the country.)
AND ALL BRITISH.



THE

ARORA ELECTRIC FIRE

Has given universal satisfaction.

WHY? Because OUR patented Element is of HEAVY SECTION and has LOW Current Density, yet it glows at a HIGH TEMPERATURE.

Low Price, Robust, Cheery, Economical.

Write for List E (Fires & Cookers) to Sole Manufacturers:

THE ARORA CO., Loughborough

(Proprietors: MESSENGER & CO., LTD.)

SEND IT TO—

REPAIRS WINDS DESIGNS

COLLINS ELEC. LTD.,

115, CLERKENWELL ROAD, LONDON, E.C. 1. TEL: HOLBORN 212.

23.

an

"

Ltd.,

ONDON."

, LTD.,

EN,

E.C. 1.

country.)

EH.

IRE

ION and

ATURE.

ical.

urers.)

ugh

D.,

912.

THE

ELECTRICAL REVIEW.

VOL. XCIII. NOVEMBER 30, 1923. No. 2,401.

ELECTRICAL REVIEW.

Vol. XCIII.] CONTENTS: November 30th, 1923. [No. 2,401.

	Page
A Ray of Hope	801
London's Electricity Supply	802
E.H.P. Transmission Lines Conference	802
Imperial Wireless Communications	803
Electricity and Politics	803
Criticism of British Electrical Traders	803
The Association of Consulting Engineers	803
Condenser-type Bushing Insulators, by G. L. E. Metz (*illus.*)	804
Electricity in Mining (*continued*)	806
The Institution of Electrical Engineers	807
Luminous Flux Photometry	808
New Electrical Devices, Fittings, and Plant (*illus.*)	809
Electrical Christmas Gifts (*illus.*)	810
Correspondence—	
Local Exhibitions—Glasgow	811
Single-core Cables on Three-phase Systems	812
"Strictly Home Office?"	812
The National Association of Radio Manufacturers and Would-be Factors	812
Keeping the Electrical Flag Flying	812
A Non-technical Explanation of "Power Factor"	813
The Cost of Living in India	813
The Postmaster-General and Electric Power and Lighting Undertakings	813
Working Conditions in America	814
An American Station on One Valve	814
Business Notes	814
The Hydro-electric Power Commission of Ontario (*illus.*)	819
A Visit to Association Island, by L. G. Hawkins (*illus.*)	822
Notes	826
City Notes	828
Stocks and Shares	829
Market Quotations for Chemicals and Metals	830
Electrical Imports of the United Kingdom and their Origin	831
The Electrification of the French Midi Railway, by A. Cachellery	832
The Commercial Motor Show (*illus.*)	834
The All-British Wireless Exhibition—III (*illus.*)	836
Legal	838
New Patents	839
Published Specifications	840
Contractors' Column	Advertisement page xxviii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 6d.

The Oldest Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

Technical Editor: A. H. ALLEN, M.I.E.E. *Commercial Editor:* A. H. BRIDGE.

Joint Managing Directors: G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E., A.M.INST.C.E.

Manager and Secretary: E. S. MIDDLETON.

Chairman: H. ALABASTER.

OFFICE, 4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C. Telephone Nos.: Central 8260 and 8261.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 362; R. Hill & Son, Matlock House, 33/34, Quay Street; Trade Publications Co.; 302, N.Z. Insurance Buildings, Queen Street.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 8, Warren Street.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Ditta P. Maglione & C. Strini, 88, Via Due Macelli.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt St.
TOKYO: Maruzen Co., Ltd., 11-16, Nihonbashi-Tori-Sanchome.
TORONTO, ONT.: Wm. Dawson and Sons, Ltd., Manning Chambers; Gordon & Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum.
Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

A RAY OF HOPE.

THE question of unemployment in Great Britain resolves itself into this: Can we, as a nation, get orders for our goods, either from the home market or from users in other countries? If we can, then our factories will be busy and unemployment will disappear; if we cannot, we shall have to go on taxing ourselves to provide maintenance for our workpeople who have nothing to do. Many are to be found who say that salvation lies in a longer working week, lower wages, and turning out more during working hours—in short, in reducing the labour cost of manufactured articles; but even if we suppose that workers will work all available hours for starvation wages, that manufacturers have money to pay them and material for them to work upon, and that transport is cheap and available for every need, what is to be done with the product?

The markets of Central and Eastern Europe do not exist for us at the present time, and the situation in Western Europe remains much the same as it was when we published a communication upon it some two years ago. In spite of the deferential position of Lord Rothermere's hat, there is no desire on the part of France to do business with this country, but rather the reverse.

What then of the British markets overseas? The daughter nations of the Empire have, like every nation in the world except ourselves, erected tariff walls for the purpose of developing and protecting their home industries, and, in order to give effect to the desire for Imperial Preference, the taxes imposed upon goods manufactured in Great Britain are fixed at a lower *ad valorem* percentage than those imposed upon the manufactures of foreign countries. In order to prevent dumping, the value assumed is not the price for which the manufacturer is willing to sell the article to users in the country into which he desires to import it, but the selling price in the country of origin. Countries in which the currency is at a discount are thus at a positive advantage when compared with ourselves. The selling price in the country of origin is so much lower than our home selling price that, notwithstanding the lower percentage of the duty levied on the British product, the actual amount of tax paid is more than that paid on the foreign article. The question of what steps ought to be taken to get this state of things altered has been discussed by manufacturers on many occasions, and it seems to us that if the basis could be changed to the weight, size, or number of the articles imported, this manifest handicap would be removed.

And what of the home market? To electrical manufacturers this is, and is likely to continue for many years to be, the most important. An increase of the use of electricity for domestic purposes to the extent that exists in many small towns in Canada, for instance, would not only increase business in domestic appliances to an unheard-of extent, but would render necessary the increase of supply stations to a degree that seems fantastic to-day. This would mean orders for buildings, boilers, plant of all kinds, cables, and so forth, causing electrical factories to hum with business, and feeder industries of all kinds to benefit as well. This is only one direction in which progress is bound to come. There is plenty of potentiality in the home market in our own industry; and as long as there are people hungry and willing to work, the food-producing market will be active.

At the moment of writing the General Election is upon us. Whatever the political label of the Government that emerges as a result, the question of unemployment must receive its first attention, and a cure *must* be found. Without prosperity and contentment at home, foreign policy may go hang; and schemes of social reform at home cannot be carried out unless wealth be produced to pay for them. Nay, more: we cannot profitably discuss even labour conditions with between one and two million workers unemployed.

We urged once more last week the necessity of placing contracts at home. The potentialities of the home market being simply enormous, its development is a first necessity. Notwithstanding the action of the Institution of Electrical Engineers, we have, as already stated, personal knowledge of several contracts of first-class importance that have been placed with foreign manufacturers, and in spite of the Government's requirement that contracts guaranteed under the Trade Facilities Act shall be placed at home, the threat of foreign competition has been used to bring about heavy cuts in prices.

The interests of the British Empire demand the improvement of trade and industry by the preservation of the home market as well as the free flow of inter-Imperial trade. It is perfectly obvious that present conditions cannot be allowed to continue, and that the measures are inadequate. It is not by mere economy or reduction of indebtedness that prosperity will be restored, though these are necessary and desirable things in their due place and time, and when properly brought about. The misnamed capital levy cannot, by its very nature, cause the employment of one operative now existing on the dole; it would inevitably add heavily to unemployment. The desire to skin the profiteers is one that we all feel, but if we strip every one of them of every penny, that is not a levy on capital. We have pointed out many times that capital is land, and buildings, and machinery, and the only way that a tax on them can be met is by raising a mortgage, the interest on which must be met out of current revenue, and so operates as an income tax. The capital levy is not a scheme for the production of wealth. In a world in which for years wealth has been squandered without restriction, it is the production of more wealth that is important, and only by the application, direct or indirect, of labour to our original capital, the land, can that production be accomplished. There is no other way.

Get home industries going, and safeguard the home market for the home manufacturer—that is the thing to do—recognising at the same time how vitally important is the development of export business.

London's Electricity Supply.

A LITTLE mild curiosity was probably aroused last week by the appearance in the Press of a pair of Parliamentary notices entitled "London Electricity Supply," No. 1 and No. 2. As the substance of each is practically the same, we presume we may treat them as one for our present purpose. The notices state that the whole of the London companies come under the new legislation proposed, and, from what we can gather, the notices are the outcome of a conference between the L.C.C. and the combined London companies. Those who are interested in the history of the negotiations leading up to this step will find it all detailed in the report of the L.C.C. Special Committee on London Electricity Supply, dated July 20th, 1923, which was summarised on p. 147 of our issue of July 27th and commented on in the same issue, p. 122. This report appeared in the Agenda of the L.C.C. of July 31st, and included certain recommendations which were adopted by the L.C.C. at that meeting. The Committee reported that it had had meetings with the London companies to see whether some agreement might be come to which would, at any rate, settle the London companies' part of the big London problem. The result of these negotiations with the London companies, as a whole, was that the Committee recommended that, subject to a satisfactory sliding scale of prices and dividends being agreed, the London companies be empowered to amalgamate and to have an extension of tenure for the whole of their undertakings to 1971. In 1971 the undertakings would be transferred to the Joint Electricity Authority on terms which were duly set out in the recommendation. Another concession to the companies is to be financial and administrative independence, subject, of course, to control with regard to technical development and to certain minor safeguards. The London companies are apparently now taking the necessary steps to embody these agreed points in appropriate legislative measures—and the notices are the first step.

There is, of course, nothing particularly new in these proposals themselves. The thing that is new, and it is most gratifying, is that all parties appear to be coming together in amicable mood for the common good. The fact that the L.C.C. and the whole of the London companies are agreed on the recommendations mentioned is itself a good omen, considering the chequered history of the last few years. The local authorities do not, of course, come into the present picture. The settlement covers only the operations of the London companies, and, so far as we can see, it is sufficiently watertight to leave absolutely untouched all the interests of municipal undertakings. So it looks as though possibly a key has at last been found to this jigsaw puzzle of London's electricity supply. Anyhow, it looks like a good beginning, which, perhaps, is all that anyone is justified in saying at the moment.

E.H.P. Transmission Lines Conference.

DURING this week there is being held at Paris the second international conference, dealing with the construction and operation of large electric power transmission systems at very high pressure. The importance of this conference may be judged by the fact that the first one was attended by 56 delegates from twelve countries; this year there are 88 delegates from twenty countries. In addition to the official delegates, there are about 300 ordinary members. The British delegates are Messrs. W. B. Woodhouse, P. V. Hunter, and E. B. Wedmore, representing the Institution of Electrical Engineers; Messrs. Hunter and Woodhouse also represent, with Mr. J. R. Beard, the British Electrotechnical Committee of the I.E.C. Other British engineers in attendance were Messrs. A. Page (Electricity Commissioner), H. W. Clothier, G. Blocksidge, R. L. MacLellan, C. O. Collett, T. N. Riley, A. Jacob, and R. Borlase Matthews.

Among the 38 papers that are to be discussed, England is represented by four presented by Mr. P. V. Hunter; two of these papers were written jointly with Mr. E. B. Wedmore, and one with Mr. W. B. Woodhouse.

The conference was initiated by a reception given by M. Raynald Legouez, President of the Union des Syndicats de l'Electricité; on the following day the formal work of the session was inaugurated by M. Le Trocquer, the French Minister of Public Works.

The problems of extra-high-pressure transmission of electricity are more and more urgently calling for a solution, in view of the present-day necessity of modern civilisation for a supply of electricity everywhere—in the country just as much as in the city. Hence the points raised at this conference will be of considerable interest to many readers of the ELECTRICAL REVIEW. A summarised report of the conference is being prepared for us by Mr. R. B. Matthews, and will be published very shortly. As practically every engineer of note associated with extra-high-pressure transmission is attending the conference—many of them having travelled very considerable distances to attend—it will be realised what great stress they lay on the importance of the meeting. The notes which appeared in these columns concerning the last conference brought forth a number of queries from readers, indicating that the subject of suitable

transmission lines for England is attracting close attention. Of course, very considerable progress has already been made in this direction in the British Dominions and Colonies, but a vast amount of work has yet to be done. As regards extra-high-pressure cable construction, England leads the world, but in respect of other methods of transmission, Continental engineers look upon her as being woefully backward. It is often of interest to note and take to heart what others think of us, and in this connection, conversations with many foreign engineers indicate that, except for cable and steam turbine power plant construction, England is considered to lag behind in electrical matters. So far as electrical development is concerned, there may be some truth in this view, but that our engineers are less competent than others we do not admit for one moment.

Imperial Wireless Communications.

The Imperial Economic Conference in an official report embodied a resolution affirming "the importance of establishing as quickly as possible an efficient Imperial Service of Wireless Communication," and urged the Home and Dominion Governments to take immediate action to remove any difficulties that were delaying the accomplishment of this purpose, as well as to guard against "the subordination of public to private interests." The Postmaster-General claims that he has offered the Marconi Company the traffic between this country and all parts of the Empire except South Africa and Canada, which would be reserved to the Government station. The company, on the other hand, declares that it is not aiming at a monopoly of the wireless services, but is willing to enter into pooling arrangements with the Post Office—provided that it can secure the commercial management of its services; alternatively, it proposes free competition and equal facilities.

Nevertheless, the two parties seem still unable to arrive at agreement, and the most urgent problem that came before the Conference still remains unsolved. Who is to blame?

It is difficult to judge, in the absence of complete knowledge; but on the face of it, the company's offer of free competition seems the fairest possible proposition, and we can only surmise that the Post Office is afraid to take up the challenge—it wants a field of operations partitioned off for itself, in which its commercial efficiency will not be capable of appraisal. But of one thing we are quite certain—that an immediate settlement of the dispute is urgently necessary, for the public interests are undoubtedly being subordinated to those either of the Post Office or of the company.

Electricity and Politics.

Electricity supply evidently bids fair to become a factor in the political world. Lenin, in fact, professed to find in electrification a key to one of his most difficult political problems, namely, how to organise the peasantry. The Soviet system obviously implied industrial organisation, and nothing could be further removed from this than the primitive conditions of Russian peasant life. Lenin's problem was therefore how to industralise agriculture; how to deal with this heterogeneous disorganised peasantry. His own words are interesting: "Is it possible," he writes, "to realise the direct transition of this state of pre-capitalist relations prevailing in Russia to Socialism? Yes, it is possible to a certain degree, but only on one condition, which we know, thanks to the completion of a tremendous scientific labour. That condition is: electrification." From Mr. Borlase Matthews to Lenin is a far cry, but here is a political vision directly inspired by such rural electrification experiments.

Again, nearer home, we find electricity similarly dominant as a political theme. This time it is in a booklet recently issued by Mr. Herbert Morrison, L.C.C., entitled "Better Times for the Housewife." The author concerns himself with "How labour policy will lighten domestic toil." The way, of course, is the "electric way," and excellently does Mr. Morrison write on the theme. So effectively indeed does he deal with "electrics" that "politics" becomes merely a propaganda by-product. Then, lastly, there is the part which electrification plays in the political unemployment programme. At present this is a minor part. But it is to be hoped that our own staid ministers will be converted to at least some little of Lenin's enthusiasm for electrification, though with a different end in view. In its early years, electricity supply suffered much from "politics" and politicians. Now, whatever be the particular aims of the various politicians of the day, we welcome the new dignity given to the industry by their increasingly flattering recognition (!)) profoundly hoping the while that it will not suffer harm from such questionable company.

Criticism of British Electrical Traders.

Attention may be directed to a letter from "Hadsum" appearing in our "Correspondence" columns to-day. We have no doubt that the firms which are the targets for his criticism will be able to give a good account of themselves—if the cap fits! But we feel that the efficiency or inefficiency of the dispatching and other departments on the commercial side of the electrical industry is a subject which might be profitably discussed. No doubt there is room for legitimate criticism and need for considerable improvement. Only good can result from the fullest ventilation of the matter, and we welcome constructive criticism of British methods of commercial organisation, but our correspondent knows as well as we do that our factories are far from working at their full capacity, and that there is consequently pressing need for contracts to be placed where they will make employment for British workpeople.

The Association of Consulting Engineers.

The annual dinner of the Association of Consulting Engineers was marked by the attendance of all but one of the Electricity Commissioners, and members of other Government departments, besides representatives of the Bench and Bar. The presence of the heads of the leading engineering bodies, including the Institution of Civil Engineers (which formerly held somewhat aloof from "Dykes's baby," as it has been called) was also worthy of note. The Association is, in fact, in a fair way to gain recognition as the only body truly representing the profession of which its membership wholly consists, and may eventually secure privileges similar to those which are accorded, for example, to the Institute of Chartered Accountants, whose members alone, we believe, may be employed to audit the accounts of public authorities.

The Association was formed for the purpose of co-operation and protection of engineers whose work was purely consultative, and from the first has rigidly excluded from its ranks every engineer in any way associated with commercial or manufacturing interests; consequently its membership is relatively very small—less than 100; but it is claimed that even if every engineer in the country who complied strictly with the conditions of eligibility were enrolled, the membership would not be increased by more than one-third. Obviously the proportion of consulting engineers thus defined to the huge memberships of the big institutions is microscopic, and this consideration amply justifies the existence of the Association as a separate body.

At the time of its formation we took exception to its proposed constitution on certain grounds, in common with other critics; we have, however, no hesitation in acknowledging the value of its work, for the maintenance of the highest standards of professional conduct and the raising of the status of engineers, which are amongst its primary objects, are purposes with which we are in the fullest accord, and which, we believe, the Association has most efficiently performed.

D

CONDENSER-TYPE BUSHING INSULATORS.

By G. L. E. METZ.

The generation of large amounts of electrical energy has resulted in a steady increase in the working pressures that are adopted on large systems. Not so many years ago a pressure of 11,000 volts ranked in the higher part of the range usually met with; to-day a number of schemes are in operation at a pressure of 33,000 volts in this country, and the tendency is still for these pressures to increase.

This state of affairs has given the question of insulation a far more important position than it held in the past, but a great deal of investigation and research is still required before the economical use of insulation will be as firmly established and understood as that of other electrical materials.

Mr. F. W. Peek, Junr., in his book, "Dielectric Phenomena," touches on the design of ordinary bushing-type insulators, and it is assumed that this fundamental treatment is known.

A few remarks dealing with the design of condenser-bushing insulators are given in this article, which it is hoped will prove of interest.

Considering a bushing insulator of the ordinary homogeneous character, the potential gradient at any point at a distance x units from the conductor is given by—

$$G = v/x.\ \log_e (R/r) \qquad (1)$$

Where G = potential gradient.
" R = external radius of insulator.
" r = radius of inner conductor.
" x = distance from conductor.
" v = maximum instantaneous value of test pressure.

If various values of x are substituted in the equation above, it can be seen that the dielectric stress is very high at the conductor surface, while the insulation further away is very slightly stressed. In fact, G max./G min. is proportional to r/R. It is evident, therefore, that while the insulation farther away from the conductor is quite capable of withstanding as high a dielectric stress as that situated immediately next to the conductor, it is not called upon to do so, and is therefore not being worked to its fullest capacity.

This state of affairs is the reverse of economical, and the problem is so to design the bushing insulator that the electrical stress is equally shared throughout its radial depth.

Now, the equipotential surfaces about a conductor of this type form concentric cylinders in the region of the metal clamp, and if an infinitely thin metallic cylinder were slipped over the boundary line of an equipotential surface the field would not be affected.

Referring to fig. 1, a bushing-type terminal is shown together with the general form of the equipotential surfaces that surround it, while in fig. 2 an elevation is shown of the insulator and conductor in section, the equipotential surfaces being replaced by a number of metallic concentric cylinders shown by dotted lines.

This arrangement is virtually a condenser-bushing-type insulator; the thin metallic cylinders referred to above are specially dimensioned and spaced one to another so that the capacity of each section is constant throughout the bushing. As its name implies, it consists of a number of concentric condensers in series; if the voltage is to be equally divided over each of the condensers, their capacities will have to be constant throughout, and the calculations made are a means to attain this end.

Fig. 1.

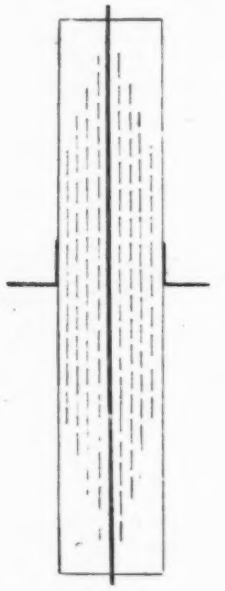


Fig. 2.

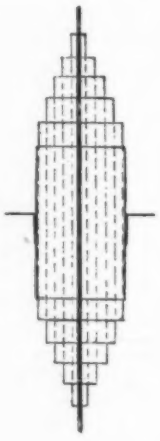


Fig. 3.

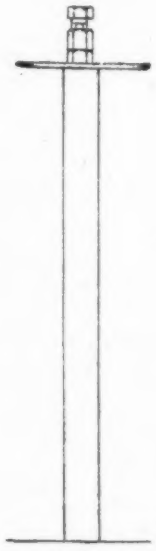


Fig. 4a.

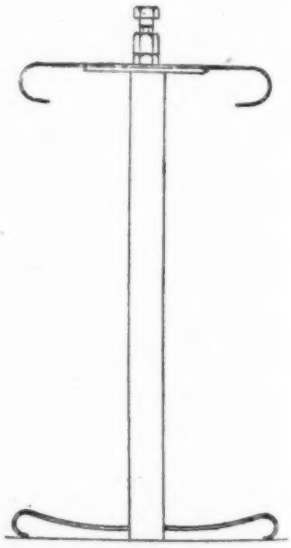


Fig. 4b.

When designing insulators of this type, the allowable gradient for the particular insulation used is a known quantity G; the maximum test pressure that the insulation will have to stand, v, is also known, therefore the radial depth of the insulation required, T, can be obtained right away by the formula $T = v/G$. An insulator will be required, therefore, whose inner radius will be fixed by the size of the inner conductor, and whose radial depth will be given by v/G, both of which are known.

At this point it is advisable to fix the voltage that it is proposed to allow over each condenser. Suppose this be 5,000 volts (a good figure to assume); the number of pieces of concentric metal foil required will then be given by v/5,000, and each of these sheaths must be arranged to provide a constant capacity over each of the wrappings or layers.

Now, the capacity of a condenser of this concentric type is given by—

Areas of plates $\times$ K/thickness between plates = π DL $\times$ K/t.

Where π D = circumference of sheath.
" L = length of sheath.
" t = thickness between sheaths.

As the capacity of each section has to be kept constant, but need not be specifically calculated, any constants such as π, K, &c., which occur for each wrapping, may be ignored. We then find that the capacity is proportional to the diameter and length of the metallic sheaths, and inversely proportional to the thickness of the dielectric between sheaths, or is proportional to—

$$DL/t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

It has already been decided, however, to keep the voltage between individual sheaths constant, namely, at 5,000 volts; the thickness of dielectric between sheaths from this consideration can also be constant, and t can therefore be ignored in equation 2. Two factors only remain, and their product must be kept a constant, namely, the diameter and the length of the sheath; it is permissible to write, therefore—

$$DL = \text{constant} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

The voltage across each wrapping or section will be constant throughout the insulation, provided the product in equation 3 remains constant. Unfortunately, the length of the metallic foil is also affected by other considerations. Referring to fig. 3, where a typical condenser bushing is shown, it can be seen that the distance between the ends of any two consecutive sheaths must be ample to withstand a voltage of 5,000 volts. The distance will be considerably more than that allowed between cylinders, for, although the actual voltage existing is identical in each case, the dielectric stress due to flux concentration at the edges of the metallic foil is very much greater. In the particular insulator shown, a distance of 28 mm. was allowed, and while, of course, the product of DL could not be kept absolutely constant, the inaccuracy introduced was not sufficient to warrant any corresponding change in the distance allowed between sheaths t. A check should always be made to ensure that this last is not necessary, and if the length of sheath per step is plotted against the serial number of the step, the points obtained should lie on a logarithmic curve. In practice, however, the effect of creepage along the metallic sheaths and flux concentration at the ends is usually counterbalanced by making the length of each sheath lie in an oblique straight line, the inclination of which is fixed by the factor of safety employed.

It can be seen at once that it is possible to design the bushing for either minimum radial thickness or minimum overall length, but a compromise usually gives the most economical design.

The total length of the insulator will depend upon the surface creepage of the particular insulation used, which is known; the length, and internal and external radial dimensions of the bushing insulator can all now be fixed. By the method given above, it is possible to calculate the number, size, and spacing of the inter-sheaths required, and the insulator can be said to be designed.

Considerations Affecting Radial Dimensions.

Certain considerations should be made with regard to the best radial dimensions to assume for both the conductor and the bushing before the design is actually started upon on the lines given above. Suppose the voltage V, the current, and the maximum stress on the dielectric, are all fixed, as is usually the case, when the problem is presented to the designer; and, further, let us suppose that the conductor is solid, of cylindrical shape, and of radius r.

To obtain the most economical radius of conductor and bushing, use can be made of Russell's formula for single-core cables.

The maximum dielectric stress occurring in the insulation is given by—

$$G = V/r \log_e R/r.$$

Where R is the radius of the bushing.
Then

$$\frac{R}{r} = e^{\frac{V}{rG}} = e^{\frac{T}{r}}$$

Where T = V/G, the safe thickness of insulation to employ for the voltage V.
Differentiating

$$dR/dr = e^{\frac{T}{r}}\left(1 - \frac{T}{r}\right)$$

From this equation it can be seen that if r is greater than T, then dR/dr is positive, and as the radius of conductor increases, so the radius over the insulator increases.

If, however, T is greater than r, then dR/dr will be negative, and therefore the radius of the insulator R will decrease as the radius of the conductor increases until r = T.

At very high voltages, the necessary section of the conductor is very small, as the current is usually of a low order; in order to economise insulation, it is very often advisable to make the conductor hollow so as to get the required value for r, with a consequent saving of insulation.

Before leaving this section of the problem it should be noted that if the full benefit of the condenser effect is to be obtained, the outer metallic sheath must be at earth potential, and it is usual to wind on binding wire which is connected to this outer sheath and earthed in order to get this effect; the length of this binding wire is fixed by the same considerations as govern the metallic sheaths.

Mention should be made of the use of metal caps at the top of bushings for the purpose of flux control. Considering an extreme case, if the conductor was brought through the bushing insulator and ended in a point, the flux density would be very high about that point, probably causing the breakdown of the surrounding air, with consequent brush discharge. If a metal hat is provided of ample size and smooth, with no rough corners, the flux density will be greatly reduced, materially affecting the arc-over voltage of the insulator and increasing it. An interesting example is cited below illustrating this fact.

Referring to the standard e.h.p. transformer bushing shown in fig. 4A, this bushing was tested, and flash-over occurred at 60,000 volts. The metallic guards shown in fig. 4B were then fitted, and the bushing re-tested, with the result that the flash-over pressure had increased to 80,000 volts.

There is little doubt, however, that as the voltage increases, the static shield will be found quite insufficient for controlling the electric field, and a new method of grading will have to be adopted; that is, grading in a vertical plane; it has been shown by other writers that great things may be expected of this new method, which, so far, is only in its experimental stage.

Association of Consulting Engineers.—The annual dinner of the Association of Consulting Engineers (Inc.) was held at St. Stephen's Club on November 21st, Mr. J. Mitchell Moncrieff, C.B.E., M.Inst.C.E., chairman of the Committee of the Association, presiding over a distinguished gathering of some 135 members and guests. Following the loyal toast, "The Houses of Parliament," proposed by Mr. H. P. Hill, M.Inst.C.E., was responded to by Lord Queenborough. The A.C.E. was toasted by Sir Malcolm McAlpine, K.B.E., and the chairman responded, while the "Bench and Bar" were proposed by Mr. G. Midgley Taylor, M.Inst.C.E., Mr. Justice Shearman and Messrs. A. Macmorran, K.C., and H. P. Macmillan, K.C., responding. "Kindred Institutions" fell to the lot of Mr. S. R. Lowcock, hon. treasurer, A.C.E.; the president of the Inst. C.E., Sir C. Longbridge Morgan, C.B.E., replied on their behalf. Finally, "The Hon. Officers" were toasted by Mr. S. C. Lewis, for whom the hon. solicitor, Mr. F. E. Wright, and the hon. secretary, Mr. A. H. Dykes, replied.

ELECTRICITY IN MINING.

(Continued from page 764.)

From the report of the Chief Inspector of Mines we much regret to learn that during the year 1922 there were nine fatal accidents at coal mines directly due to electricity. Two of these occurred on the surface works and seven below ground. One of the accidents below ground arose from the defective condition of the control switch on a coal-cutting machine resulting in the death of one man following severe injuries. Electricity was also a contributing cause in bringing about an ignition of firedamp resulting in the loss of two lives.

The number of persons killed by electric shock below ground in coal mines was: In 1907, 10; 1908, 12; 1909, 13; 1910, 15; 1911, 9; 1912, 7; 1913, 13; 1914, 4; 1915, 8; 1916, 4; 1917, 2; 1918, 6; 1919, 6; 1920, 3; 1921, 1; and in 1922, 6. This increase in number over that recorded for the two preceding years is very much regretted, particularly because, as may be seen from the descriptions of the accidents, they may all, with one doubtful exception, be classed properly as preventable accidents.

The following notes on accidents due to electricity have been compiled by Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines.

1.—Fatal Accidents.

(1) *Rosehall No. 4 Pit (Lanark).*—Deceased, aged 33, was a coal-cutting machineman and was trying to locate and remedy a defective contact in the starting switch of his machine, for which purpose he had removed the cover of the switch enclosure after withdrawing the live "bat." Failing in his endeavour, he sent for the electrician on duty, pending whose arrival he continued his efforts. Having bridged one pair of contacts with a piece of copper wire, he re-inserted the "bat" and switched on. As the motor still failed to start he switched off, and without withdrawing the "bat" (plug connector) proceeded to press other contacts with his fingers.

He was found apparently dead, with one hand on the switch terminals and the other on the machine frame; both hands showed burns. Artificial respiration was attempted, but proved ineffectual. The electrical system was three-phase at 500 volts, the neutral point being nominally insulated.

(2) *Silver Hill (Notts.).*—Deceased, aged 26, was a cleaner-out, assisting the coal-cutting machineman. He was sawing a prop a few yards from the machine close to the face, and adjacent to a wire haulage rope which was attached at one end to a prop and at the other end to the haulage drum of the coal-cutting machine. The machineman had removed a defective switch unit from the machine and substituted another, which he obtained from the electrician in charge. This spare switch had been repaired some weeks previously and put into store. After effecting the replacement the machineman took his snap and then switched on at the gate end box before inserting the "pommel"; he received a severe shock which threw him clear of the machine. Current was then switched off at the gate end and the "pommel" withdrawn, after which deceased was looked for and found, apparently dead, lying on his face. Artificial respiration was attempted, but proved ineffectual. Subsequent investigation showed that the insulation of the switch mechanism had broken down so that the machine frame and the attached wire rope were "live." The construction of the "pommel" was such that the "live" circuit was closed before the earthing contacts, so that the earthing safeguard was inoperative while the "live" "pommel" was being inserted. The electrical system was three-phase at 500 volts, the neutral point being nominally insulated.

(3) *Bowhill No. 2 Pit (Fife).*—Deceased, aged 38, was employed with others operating an electrically-driven coal-cutting machine, and was dragging a length of old wire haulage rope from the heading to the machine, intending to use this old rope as a temporary replacement for that on the machine which had been severed accidentally. It appears that the rope, which had many projecting sharp ends of broken strands, was drawn across the trailing cable where the latter lay upon the floor at a point where it crossed the level. Upon examination of the trailing cable indications of injury were found, and it is probable that a projecting strand of the wire rope had come in contact with one of the conductors of the cable so that the rope became "live," with the result that the deceased received a severe shock rendering him unconscious. Help being at hand, artificial respiration was promptly resorted to and persisted in by hand for about 45 minutes. A "Pulmotor" was then tried for another similar period until the oxygen was exhausted, but without avail. The electrical system was three-phase at 500 volts, the neutral point being nominally insulated.

(4) *Manners No. 2 Pit (Derbyshire).*—Deceased, aged 36, was an assistant electrician in responsible charge of the electrical equipment underground. On the day preceding the accident he had disconnected a small transformer in a switch room near the pit bottom, but had not removed the high-pressure cable, the ends of which he covered with black adhesive tape within the transformer container. The next morning, to complete his work, he re-opened the transformer container without first cutting off the pressure, and received a severe electric shock from the taped end of the cable, causing him to cry out. An official of the mine was at hand, who promptly switched off the circuit, whereupon the deceased fell to the ground. Artificial respiration was applied at once and persisted in for 30 minutes until the arrival of a medical practitioner, and for 60 minutes thereafter, but deceased did not regain consciousness. There was a severe burn between the third and fourth fingers of his left hand. The electrical system was three-phase at 3,000 volts, the neutral point being insulated.

(5) *Watnall Mine (Notts.).*—Deceased, aged 27, was a coal-cutter driver detailed to fit machines and leave all in readiness for the following coal-cutting shift. He had fitted an electrical chain-type machine, and was about to jib-in at the coal face. Having inserted the "pommel" at the machine, he sent an assistant to close the gate-end switch, and then leaned over the machine to reach the handle of the starting switch of the machine motor and started the machine, but remained lying across it. His assistant realised that something was amiss, and sent a third man to switch off at the gate-end, whereupon deceased's body slid off the machine. Within the "pommel" box on the machine there was a small extraneous piece of copper wire which accidentally connected one of the electrical circuit contact pins to the box when the "pommel" was inserted, so that the machine frame became "live," and deceased received an electric shock which prevented him from crying out or letting go. It was found that the earthing circuit was interrupted between the trailing cable and the gate-end switch box. The contact spring in the pommel box was broken, and the auxiliary earthing bond, provided by means of a jumper cable between pommel and box, had not been connected. Artificial respiration was tried, but deceased did not regain consciousness. The electrical system was three-phase at 500 volts, the neutral point being earthed through 25 ohms limiting resistance.

(6) *Murton Mine (Durham).*—Deceased, aged 46, was an electrician's skilled labourer, and was employed above ground at the time of the accident cleaning switchgear, under the general supervision of an electrician. During the forenoon he had been at work underground upon a switchboard from which all pressure had been cut off. In the afternoon he was set to work on a cubicle type switchboard in a sub-station at bank, having been

given a key which enabled him to open all protecting doors. Pressure had not been cut off the chamber containing the isolating links, which intervened between the bus-bar chamber and that in which the switch itself was housed. The isolating links had been drawn, and the door replaced and locked, but deceased was not cautioned when he was set to work on the switch chamber. Having cleaned the switch, deceased opened the protecting door above and was proceeding to clean the link insulators, holding on the ironwork with one hand for support, when he received an electric shock from one terminal which caused him to cry out and fall to the floor. His cry was heard, and artificial respiration was applied at once and continued for nearly an hour, but he did not regain consciousness. Both hands were slightly burned. The electrical system was three-phase at 5,000 volts, the neutral point being earthed.

(To be continued.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Wireless Section: Chairman's Address.

Mr. E. H. Shaughnessy, O.B.E., chairman of the above-named section of the Institution, delivered his inaugural address in London on November 7th, in the course of which he reviewed briefly a few radio developments and then gave an account of some of the experiences met with in completing the Leafield high-power station.

He said, *inter alia*: This country appears to have started its broadcasting under conditions which the directors of the Radio Corporation of America indicate in their annual report for 1923 as essential for success.

At the first meeting of representatives of the trade at the Post Office, Mr. Dane Sinclair suggested that in order to reduce the heavy cost of running eight different programmes nightly the Post Office trunk lines should be hired, at any rate, for partial simultaneous transmission, but there were many of us who thought that the over-hearing troubles, attenuation, and distortion would be too much to permit of any large degree of satisfactory simultaneous broadcasting of musical programmes. The Post Office engineers, however, have been able to select or make up such good trunk lines for this purpose that the engineers of the British Broadcasting Co. have had every opportunity to exercise their skill and ingenuity.

The quality of broadcast music is a scientific development of no mean order and successful simultaneous broadcasting has given this country the lead in that branch of the art. Broadcasting should prove to the non-technical man that radio telephony cannot supplant ordinary wire telephone exchanges, for by now he knows how easy it is to overhear speech and how very difficult it is to hear any but the speaker making the most noise when comparatively near to a sending station.

Apart from the Beverage antenna, of which I cannot speak from experience, so far as reception is concerned, there seems to have been no recent improvements. The life of transmitting valves is steadily improving. At a station where ten valves were in use 18 valves were renewed in 1921 after an average life of 450 hours; in 1922 five valves were renewed after an average life of about 1,000 hours; and up to date this year three valves have been renewed after an average life of over 3,000 hours; several of the valves now in operation have already run over 5,000 hours. At another station where 14 larger glass valves are in use they have been working for over 4,000 hours and only one has burnt out. The hours stated above are, of course, actual working hours, and do not include any idle time. They are glass valves of the General Electric Co.'s make, and it is imperative that the filaments be run at a constant voltage if long life is to be obtained. We expect a life of from 6,000 to 8,000 hours from the valves now in use. There has also been marked development in the power output of individual valves. Some Western Electric Co.'s anode water-cooled valves were installed at Northolt in July last and are still running. They are rated to give an output of 10 kW at 10,000 volts on the anode. We carried out an overload test on three of the valves at 12,500 volts on the anode for three hours and obtained an output of 42.5 kW in the aerial, or over 14 kW per valve. The anode is rated to dissipate 10 kW. With an output of 10 kW at 10,000 volts on the anode at 66 per cent. efficiency there are satisfactory working factors of safety on both anode voltage and dissipation.

All the parts of the Holweek water-cooled valve are easily demountable and a working pump is permanently attached whilst it is in operation. An input of 10 kW at 5,000 volts on the anode has given an output of 8 kW oscillating energy, and a burnt-out filament can be renewed at a very low cost in a very short time. One of these valves has been working in the Eiffel Tower station for some time.

The Admiralty has successsfully developed the silica valve, and valves with an output of 5 kW with 10,000 volts on the anode have been in commercial use for some time.

An Admiralty silica valve with 12,000 volts on the anode has an input of 33 kW and an output of 21 kW. The filament can be renewed expeditiously at a small fraction of the cost of a new valve. We should now rate valves on their output power anode volts and anode dissipation.

The Leafield station is equipped with 250-kW Elwell-Poulsen arcs, and as soon as it was operated the large number and strength of the harmonics and other undesirable emissions caused us much perturbation. Quite apart from harmonics, another type of undesirable emission produces a general rushing, noisy, disturbance in the neighbourhood of a wavelength far below the fundamental wave of the arc station. This is called "mush," and with Leafield working at about 9,000 metres the mush appeared between 2,000 and 3,000 metres. In order to pursue these matters systematic tests were carried out in 1921 at Dollis Hill.

Every harmonic up to the 16th has been observed and the characteristics of the 2nd and 3rd have been determined absolutely, whilst those of the 4th and 5th have been determined relatively. The experiments show that, generally speaking, the field strength due to an harmonic decreases with increasing order of the harmonic and that the strength decreases with decreasing aerial current to a greater extent than does the fundamental.

With 150 amperes in the aerial at Leafield, however, the emission of the harmonics is strengthened. This was observed on harmonics up to the 5th and confirmed at separate times on separate days. The harmonic emission is stronger than when there was 177 amperes in the aerial and a noticeable factor with 150 amperes in the aerial was the comparative purity of the notes of the harmonics. The note obtained on the harmonics at all other currents was complex and indicated that the emission was more in the nature of damped-wave trains than that of pure continuous waves. This is presumed to be due to variable cycle to cycle characteristics of the arc, and that with 150 amperes in the aerial the arc maintains a steadier characteristic, with consequent purified waveform and stronger harmonics. If this were the case the fundamental emission with 150 amperes should be improved, but the tests do not show that this is materially the case. Such an effect might, however, be noticed at a more distant station.

The potential gradient which, when squared, is proportional to radiated energy, decreases roughly in the ratio 2 : 3 for each harmonic. The fact that every harmonic is received, that they are true integral fractions of the fundamental, and that their strength is apparently independent of the possible normal modes of oscillation of the aerial, all indicate that the aerial itself does not oscillate harmonically, but that the emissions are due to forced oscillations set up in the aerial by the operation of the arc. By changing the fundamental wavelength and observing the wave-length values of the harmonics produced it has been confirmed that they are produced by the operation of the arc.

With an aerial current of 191 A (representing an aerial energy of about 80 kW) on 9,050 metres it is calculated that 3.95 kW are radiated; with the same conditions the radiated energy on the second harmonic (4,525 metres) is .000194 kW; with 176 A on the third harmonic (3,016 metres) the radiated energy is .00005 kW. It will thus be seen that the energy wasted in harmonic radiation from Leafield is a negligible percentage of the total radiation; it is, however, important to know that such a small amount of radiated power can cause interference and it has been suggested that the permissible undesirable emission from a transmitting station should be a percentage of the power of the station.

Experiments were next carried out at Stonehaven with a receiving station at Aberdeen, followed by further trials on a larger scale at Northolt, where both mush and harmonics had proved disturbing to some communications near London. With direct aerial working an input of 28 kW to the arc produced an aerial current of 46 amperes, and with a coupled circuit an input of 35 kW to the arc produced the same aerial current, the current in the primary circuit being 39 amps.

Observations at Dollis Hill (about seven miles from Northolt) show that with coupled-circuit working harmonics were practically eliminated and mush reduced to a negligible quantity. With a direct aerial the receiving telephone had to be shunted with 20 ohms to get rid of the second, and with 190 ohms to get rid of the third harmonics. With a coupled circuit using an extra valve on the receiver on most occasions

no harmonics were observable. On a few occasions when they were traced, a shunt of over 1,000 ohms on the telephones made them disappear.

With regard to the mush, when a plain aerial was used, signals from North Foreland could only be read with difficulty at Dollis Hill, but when a coupled circuit was in use no difficulty whatever was experienced. The wave-length of Northolt is about 7,000 metres and a coupled circuit has been installed permanently for about twelve months. The Dubilier mica condenser in the primary circuit is subjected, under working conditions, to 30,000 volts, at a frequency of about 40,000, and has behaved satisfactorily

These results have encouraged us to proceed with a coupled circuit for Leafield, where the power and voltages to be dealt with are of a greater order, but the work is not yet completed.

Penderson has experimented with a cooling shoe placed upon the top of the carbon electrode and capable of distance adjustment, the idea being that with proper adjustment the arc would rise between the electrodes, strike the cold surface of the shoe, and be instantly extinguished (the copper anode is already water cooled at the tip), the result being to make every cycle of the arc exactly similar and reduce undesirable emissions. We have tried experimental shoes on the large arcs at Leafield, but have not yet been able to form any definite opinion of the effect; the tip has melted after about half an hour's working. Coating the Leafield carbons with a thin layer of insulating material seems to produce a slight diminution of mush.

It was stated in the Imperial Wireless Telegraphy Committee's report of 1920 that one aerial ampere produced by a valve oscillator is equal to 1½ aerial amperes produced by an arc, but so far as experimental measurements of this nature are concerned the potential gradients may be said to be equal; to get equal results it is necessary to have the arc clean and in very good adjustment.

When Leafield was put in operation, if the aerial current was increased above 190 amperes the insulators on the mast stays brushed over and on some of them being removed they practically crumbled in the hand. Inspection indicated that they had been subjected to intense internal heat. With arc working the aerial current is continuous and the stay insulators get no rest from dielectric stresses and no chance of cooling down, and the crumbling of stay insulators may result in the collapse of a mast during a gale.

It was decided to short-circuit the insulators in all the top stays of the masts and at the same time bond the stays to the masts at their top ends, well earthing the bottom ends. The change was made gradually from June to September, 1922, and the radiation has not been affected to any measurable extent by the cutting out of stay insulators. It has allowed the normal working aerial current to be increased from 190 to 250 amperes without any fear of trouble from broken insulators. The insulators supporting the aerial have given no trouble.

The aerial tuning inductance is 12 ft. in diameter and is supported on columns of hollow porcelain reels. In order to make them rigid paxolin tubes were passed through their centres, hooked to the bottom support, and clamped tightly at the top. After a period of working these caught fire and the porcelain was punctured; dry wood was then tried, with no better result, but a wooden spider placed at the top of the tuning coils to hold the columns together has stood the test of time.

Recently, during some building alterations to the aerial-tuning inductance room, a temporary wooden partition about 8 ft. from the coil became damp during a storm and shortly afterwards caught fire as the result of being in the field of the high-frequency currents. The builders had been warned to keep it dry, but were of the opinion that the warning sounded like a fairy tale. Further trouble was overcome by erecting a screen of about 12 copper wires between the coil and the wooden partition.

LUMINOUS FLUX PHOTOMETRY.

Messrs. Everett, Edgcumbe & Co.'s "Cube" Photometer.

With the introduction of the gasfilled lamp, and still more of the various indirect and semi-indirect fittings now so commonly used, the measurement of average candle-power in a horizontal plane has become of less value than that of the average in all directions, *i.e.*, the "mean spherical candle-power." For many purposes it is still more convenient to measure the luminous flux emitted from the lamp. The unit of luminous flux is known as the "lumen," and is such that a luminous source of one candle emits a total flux of about 12½ lumens (or more accurately, $4\pi = 12.57$ lumens). If, on the other hand, the candle-power of the source is not uniform in all directions, but has a mean spherical candle-power of one candle, it will likewise emit a total luminous flux of 12½ lumens. This flux can be collected and sent out in all the required directions by means of suitable reflectors, translucent globes, &c., and in this way the efficiency of a given lantern can be expressed as a ratio of the luminous flux emitted in useful directions, to the total luminous flux emitted by the lamp. If the lamp and its fitting are regarded as a single unit the efficiency may be expressed as a ratio of the useful luminous flux to the watts consumed by the lamp.

The term efficiency has so long been used to denote what is actually the inefficiency of the lamp, *i.e.*, the ratio of the watts input to the candle-power output, that the term "specific output" has been adopted to denote the true efficiency, *i.e.*, lumens per watt.

It will readily be seen that for many purposes this conception of luminous flux is very valuable, and it is becoming more and more common to rate lamps in terms of lumens, rather than of candles, which latter quantity, as has already been shown, requires further qualification before it can convey any really definite meaning. It thus becomes a matter of importance to be able to measure the total lumens emitted by a lamp, but such a measurement is laborious when carried out by means of the ordinary photometer.

It was suggested by Ulbricht that if the source of light was placed in the interior of a large sphere with a carefully

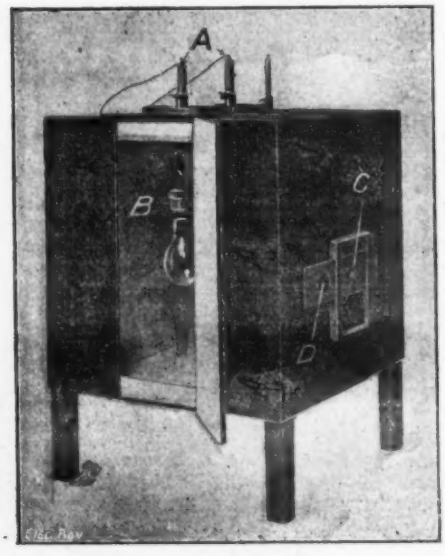


Fig. 1.

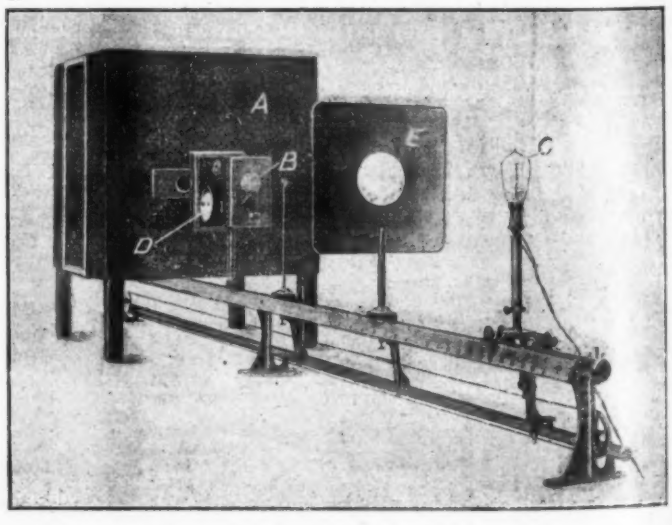


Fig. 2.

whitened inner surface, the illumination of this surface would be the same all over (even if the emission of light by the lamp varied greatly in different directions), and would, moreover, be proportional to the total lumens emitted. Large spheres have been constructed on this principle, which give excellent results in skilled hands. They are, however, both cumbersome and expensive, and have been shown by Dr. Sumpner and others to be quite unnecessary.

The Everett-Edgcumbe "cube photometer" is based upon the researches of Dr. Sumpner, and consists of a cube with 27-in. sides. The internal corners are filled in, so as to give a 14-sided cavity, with specially whitened inner walls. The whitening of the interior calls for considerable care and experience. Not only should the surface be truly "matt," and have a high reflection ratio, but it must also be so "white" as not to interfere with the colour of the light emitted by the lamp; otherwise the difficulty of obtaining a photometric balance, due to difference in colour, is greatly increased. Furthermore, the surface must be such that it will not readily discolour with time or heat.

Fig. 1 shows the general appearance of the "cube" with door open. It is provided with two internal lampholders, fitted to adjustable rods A, through which pass the flexible leads carrying the current to the lamps. As usually constructed a standard bayonet-catch lampholder is fitted to one rod and a large Edison screw lampholder to the other (B in fig. 1), so that lamps with either form of cap can be tested at will.

On the right-hand side of the cube is a circular opening C, glazed with double ground glass, the exposed area of which may be varied by means of the sliding diaphragms seen at D in the illustration. This ground glass window is illuminated by the internal lamp and assumes a brightness directly proportional to the lumens emitted by that lamp, so that either a direct measurement can be made by means of a brightness photometer, such as the same maker's "Luxometer," or the ground-glass window may be treated as a source of light, and its value measured by a bench or other form of photometer.

The use of the Everett-Edgcumbe bench photometer for the purpose is shown in fig. 2. A represents the cube, which is supported on a stand of such a height that the ground-glass window is on a level with the photometer head. The adjustable head shown at B in fig. 2 is the combined flicker and inclined screen head of Messrs. Everett Edgcumbe which, besides being available for use as a flicker, or as an equality-of-brightness photometer at will, gives a very large range of readings on the head itself by means of the internal inclined screen, which carries a pointer moving over a scale D. The comparison lamp C is connected in parallel with the lamp under test in the cube, and balance of illumination is obtained by moving the lamp C up to or away from the photometer head.

The screen B serves both to shield the observer's eye from any glare due to the lamp C and also to intercept any stray or reflected light which might otherwise reach the photometer head.

In making a measurement a lamp of known luminous output L (expressed either in mean-spherical candles or in lumens) is placed in the cube, the voltage is adjusted, and a photometric balance is obtained with the lamp C at R_1, say, on the scale. The standard lamp inside the cube is then replaced by that to be tested, and a second point of balance R_2 is obtained. The luminous output of the lamp under test is then $L \times R_1/R_2$, the result being in mean spherical candles or in lumens, according as L was expressed in the one or the other unit.

By means of this equipment candle-power measurements from 10 up to 10,000 mean-spherical candles (or, say, 120 to 120,000 lumens) can readily be made, and, if desired, the photometer scale can be so graduated as to enable the luminous output to be read off directly.

Messrs. Everett-Edgcumbe have also developed a complete unit, consisting of a cube similar to that shown in fig. 1 combined with a compact photometer, complete with standard lamp and scale, which gives directly the luminous output of the lamp under test in mean-spherical candles or in lumens, as desired.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electrically-operated Curtain Gear.

The accompanying illustration (fig. 1) is a diagram of the electrically-operated curtain gear in the Society of Arts meeting room. The meeting room derives its light in the daytime from a glass dome, the base of which is 12 ft. in diameter and some 40 ft. above the floor level. The room is frequently used for lectures during the day-light hours, and to enable slides to be shown it was necessary to devise some means of rapidly darkening the room. The covering and uncovering had to be carried out rapidly, and reliability was of first importance owing to the height. After considerable thought and experimenting with models, the scheme described below was decided upon. At the base of the ventilating cowl fixed at the top of the dome a circular iron ring was already in existence, and to this twelve stout copper wires were stretched to the base of the dome, these forming the guides for the curtain. The curtain itself was constructed of black material made up in the form of an umbrella in sections to fit the space enclosed by the guide wires. At the points which would be occupied by the ribs of an ordinary umbrella a series of rings were sewn on the outside or top of the curtain and threaded over the guide wires to support it. The edge of the curtain was suitably weighted round the whole of its circumference so that when the main holding cord was released, it would fall by gravity. Attached at equidistant points to the bottom and on the inside of the curtain are six short pulling cords, these again being joined to one main cord passing up through the ring to which the rope of the curtain and guide wires are fixed. The diagram makes the general arrangement clear. The operation of opening and closing the curtain is carried

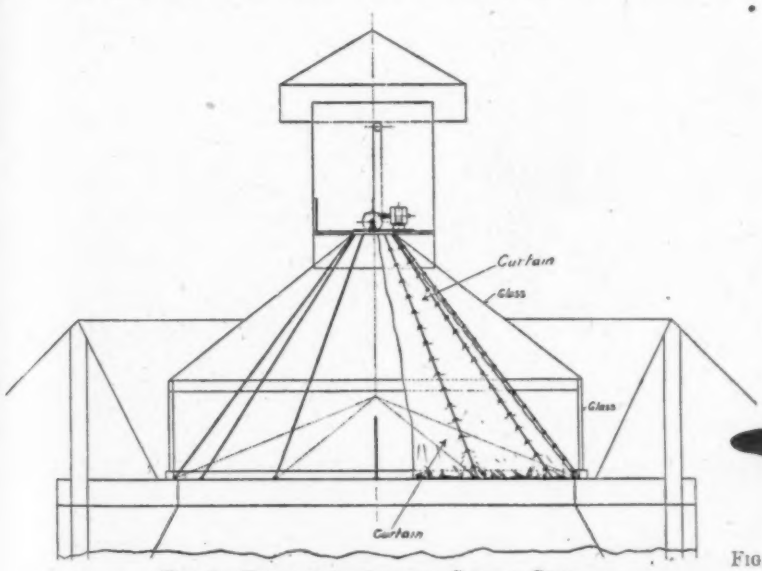


Fig. 1.—Electrically-operated Curtain Gear.

Fig. 2.—The "Luxor" Lighting Unit.

Fig. 3.—The Unit Fitted with Shade and Screen.

out by a small electric winding gear fixed in the base of the cowl. This gear is fitted with limit switches, and is operated by remote push-button control at the back of the room. All the lantern operator has to do should he wish to darken the room to show a slide is to press the button at his side and the curtain descends in about four seconds, completely darkening the room. The reverse operation takes an equally short time. This system was worked out jointly by the architect, Mr. A. T. Bolton, F.R.I.B.A., who was responsible for the extensive alterations to the Society's buildings, and Edmundson's Electricity Corporation, Ltd., Broad Sanctuary Chambers, S.W.1, who carried out the whole of the new lighting scheme and special power requirements necessary for experiments and other work in the Society's lecture room.

The "Luxor" Lighting Fitting.

The "Luxor" fitting, developed by the British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2, completely eliminates glare, and produces an illumination which, while beautifully soft and perfectly diffused, is not rendered inefficient through absorption. The fitting, which is complete in itself, and is the basis of all "Luxor" units, is illustrated in fig. 2 (p. 809). It consists of a vitreous enamelled metal reflector of special contour to which a diffusing bowl is attached. Both the inside and the outside surfaces of the reflector are used for reflection. The light distribution is as follows: About 75 per cent., in the form of indirect illumination, is reflected upwards to the ceiling from the inner surface of the reflector. The remainder of the light passes directly from the lamp to the diffusing bowl through which the light is filtered to an agreeable softness. A small proportion of the light which reaches the diffusing bowl is thrown upwards through the top edge of the glass on to the outer surface of the enamelled reflector. It is this almost negligible amount of light which imparts the softly diffused illumination to the silk shade.

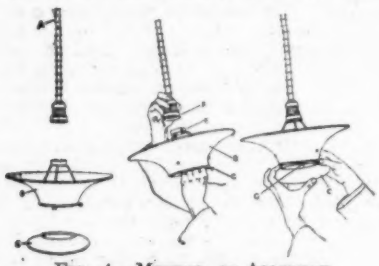


Fig. 4.—Method of Assembly.

An additional effect is obtained by the use of a silk bag or screen which fits over the diffusing bowls (see fig. 3, p. 809). This is primarily intended for use where the bowl of the fitting is directly in the line of vision. Spare diffusing bowls can be obtained, and are made in two patterns, plain opal and cut glass. The ease with which these fittings can be assembled is worthy of mention, and will be appreciated from the drawings in fig. 4. The fitting comprises three essential parts: A the suspension complete with housing, ceiling plate and wiring; B the reflector with tripod; and C the diffusing bowl. Having fixed the ceiling plate in the usual manner, the reflector is attached to the housing by engaging the bayonet slots in the top of the tripod E with the pins in the housing F. This can then be securely locked by means of a locking screw. The lamp may now be inserted. The diffusing bowl is attached to the reflector by the three spring fingers G at the bottom, which engage the edge of the bowl.

Should it be necessary to alter the length of the suspension, this is quite easily effected by either adding or removing the requisite number of thimbles, and, of course, lengthening or shortening the cable. Cleaning or lamp renewal presents no difficulties, as the diffusing bowl can be removed by simply pressing the retaining finger springs clear of the edge of the bowl.

The "Luxor" system of lighting can be effectively employed in offices, shops, showrooms and restaurants. The silk shade is in no way essential, and the fitting can be used as shown in fig. 2 for office and industrial lighting.

ELECTRICAL CHRISTMAS GIFTS.

The reductions in the prices of both electricity and electrical appliances which have been taking place since last Christmas, should provide an added incentive to the purchase of electrical gifts in fulfilment of ancient custom.

While it cannot be said that the year which is closing has been rendered memorable by any revolutionary change in the nature of domestic appliances, there has been a steady advance—chiefly in the direction of cheaper and sounder construction.

The examples of suitable Christmas presents which accompany this note are not intended to be an attempt to cover the whole field (which is much too large for adequate treatment in a small space); their main object is to serve as a reminder both to sellers and buyers that in this progressive age electrical gifts are likely to meet with greater approval than the stereotyped presents which the public has borne patiently for many years.

The problem of cost does not enter into the subject, as the wide range which lies between the pocket flash lamp and (say) the electric washing machine includes appliances to suit all tastes and pockets.

Our examples do not take account of radio apparatus, as we consider that our current report upon the Wireless Exhibition amply covers this branch—the aim has been to draw attention to articles which can find useful and frequent application in the domestic sphere.

Fig. 1.—Premier Electric Heaters, Ltd.
An inexpensive pedestal heater with copper bowl and 600-W element.

Fig. 2.—Cable Accessories Co., Ltd.
A "Shell" type heater with a 600-W element. Finished black. Overall dimensions: 12¼ in. wide, 10 in. high, and 8¼ in. deep.

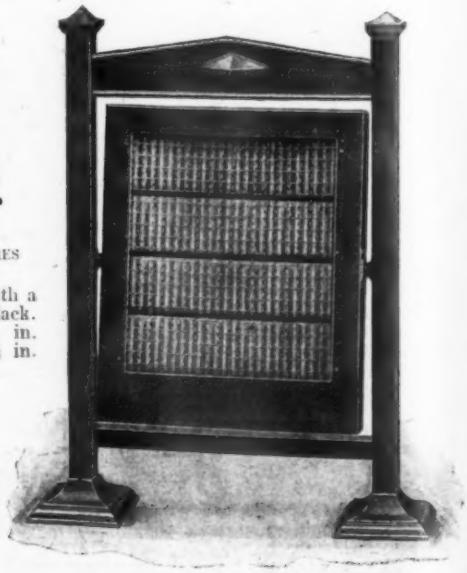


Fig. 3.—Credenda Conduits Co., Ltd.
A 3-kW fire with elements mounted in a swivelled frame, finished in antique copper, antique brass, or polished brass. Weight 18 lb.

Fig. 4.—Messrs. Ward and Goldstone, Ltd.
A neat form of table lamp with satin finish glass standard and cut-glass shade.

Fig. 5.—Messrs. L. G. Hawkins & Co., Ltd.
A 2½-pt. tilting kettle with copper body finished with nickel or silver plate. The overall height is 12 in., and the kettle is fitted with a "Universal" safety fuse plug.

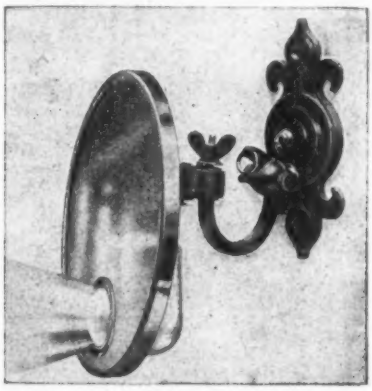


Fig. 6.—Berry's Electric, Ltd.
An electric shaving or toilet mirror solving a difficult problem. The mirror and lamp can be turned completely round.

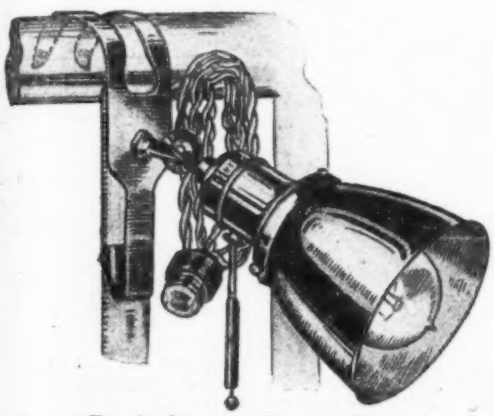


Fig. 7.—Benjamin Electric, Ltd.
A portable lamp with hanging device fitted with a dimming arrangement giving five steps. It is finished in "brushed" brass.

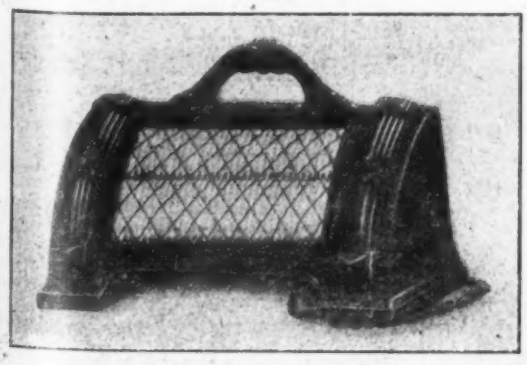


Fig. 8.—Messrs. May & Padmore, Ltd.
A small fire fitted with two 375- or 500-W bars. It weighs 11 lb., and is 13¾ in. wide, 8½ in. high, and 6 in. deep; it can therefore be placed on a table if necessary.

Fig. 9.—Messrs. L. G. Hawkins & Co., Ltd.
A "Juniorlite" lamp with clamping base and swivel adjustment enabling it to be fixed in any position.

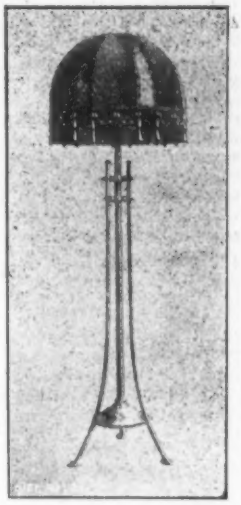


Fig. 10.—Metropolitan-Vickers Electrical Co., Ltd.
An extendable floor standard of antique brass finish, fitted with 20-in. diameter silk shade. Height 5 ft., extending to 7 ft.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Local Exhibitions—Glasgow.

As the official responsible for the operation of the showroom—we have, strictly speaking, no "sales department"—whose alleged activities are complained of, may I be allowed to repudiate in detail the charges made by "A Contractor," in his letter appearing in your columns on November 16th?

Consumers' applications, when received, are dealt with at the head office, and in no case are they forwarded to the showroom. A list of all applications received during the preceding calendar month is, however, handed to the showroom usually about the middle of each month, but be it noted that, in all but exceptional cases, the consumer has had his installation completed and connected up before this list reaches me. Our procedure is to send by post an invitation (copy enclosed) to visit our showroom, to inspect a full range of electrical apparatus, together with one or two enclosures, giving details of the apparatus (cookers and fires), which we install on hire.

The contractor in every case has a free field, and has no one to blame but himself if he does not secure business. When his client decides to place the order for the wiring of his house, surely that is the time for the contractor to acquaint him of the various appliances available, either by purchase or hire, and take him to the Corporation or other showroom, where he will see a tempting display of these.

Again, it is untrue to state that a salesman follows on to book the order. We have no staff detailed for this purpose; for the past two months our difficulty has been to keep pace with the orders for hire fires and cookers, actually being lodged without solicitation.

The use of your columns by anonymous correspondents for the ventilation of baseless grievances seems to me a prostitution of a channel oft-times very useful when used legitimately. If "A Contractor" has any real or imaginary grounds for dissatisfaction, he can always obtain immediate redress from the engineer and manager whose policy, like that of his predecessors in Glasgow, has always been one of closest co-operation with the local electrical contractors.

R. Hardie,
Manager—Showroom.
Corporation Electricity Department, Glasgow.
November 20th, 1923.

For the benefit of your many readers who are not conversant with the local conditions in Glasgow, referred to by "A Contractor" in his letter published in your issue of 16th inst., perhaps you will allow me to explain that the Sales Shop of the electricity department of this municipality is situated in the best shopping thoroughfare of the city, and

the main offices of the department are half a mile away in a less important street.

At the main office they receive from intending consumers demand notes requesting that their proposed installations, when completed, be connected to the mains.

The information thus obtained at the main office is privileged, and is obtained in the course of the department's legitimate business as a supplier of electrical energy, but they have no right to use it through their sales shop to the detriment of those ratepayers (their employers) who are electrical contractors, manufacturers, wholesalers, ironmongers, or furniture dealers, and who carry representative stocks of electric fires, iron, sweepers, &c.

If the officials wish to shelter behind their Committees, then I would ask why it is that these estimable committee-men do not give the public the benefit of the experience they have gained first hand in their own business, and help to organise other spheres of municipal trading by setting up bakeries, ironfoundries, printing presses, or drug stores?

Grid Leak.

November 20th, 1923.

"A Contractor's" letter about Glasgow's electrical showroom and its on-goings should bring out expressions of opinion on a vexed question.

Buyers from London or Hong-Kong will be supplied if they order. Why not, when people of surrounding districts are supplied, who are consumers of Clyde Valley and suppliers other than Glasgow City?

You, Mr. Editor, get to business and back up contractors in this matter.

Old Spark.

November 20th, 1923.

Single-core Cables on Three-phase Systems.

In your issue of November 16th, on page 734, you publish a letter which states that the writer has made use of a paper in the *Journal* of the I.E.E. (of which he is not a member) when writing the article under this heading in your issue of November 9th.

The terms used are common ones, and the source of information was certainly not the above *Journal*.

Sheath circuit eddies are eliminated in modern practice by earthing the sheaths of the cables at one point only, which is not by any means undesirable.

Replying to the last paragraph, it is very unusual to call upon workmen to handle "live" cables; in modern practice every protection is given the cables to prevent this happening. On single-core cables, whose sheaths are in contact, the losses will cause excessive heating of the sheaths, and it cannot in any way be considered that this is preferable, even though a workman may get a shock off a cable sheath in my arrangement; these sheaths, by the way, would be insulated throughout their length.

E. Berry Nixon.

November 20th, 1923.

In your issue of November 16th, Prof. Cramp and Miss Calderwood point out, in a letter under the above heading, that dangerous differences in voltage may occur between the sheaths of single-core cables on 3-phase systems unless they are frequently earthed. The remarks in this letter raise further interesting questions with regard to the voltages which may occur in the sheathing and armouring of either single- or three-core cables in the event of a failure of the paper insulation between the conductors and the lead sheath.

Where the neutral or another point of the system is earthed, and an unearthed phase breaks down partially or completely to the cable sheath, it will depend on the sum of the resistances in the core, in the fault, and in the portion of the lead sheath and armouring between the fault and the nearest earthed point whether or not the fault current is sufficient to operate the overload trip coils. While this fault current flows, the voltages of the various parts of the fault circuit will depend on the relative resistances of its component parts. If the fault is at some distance from a point at which the sheath and armouring of the cable are earthed, the resistance in this part of the fault circuit may be a notable portion of the total resistance, and the potential of the lead sheath and armouring may reach a high value of the order of hundreds of volts.

Sometimes a copper sheath is introduced under the lead and in contact with it, but it is not practicable to make this of sufficient cross section to ensure a safe voltage difference between the fault and an earth a mile or so distant. With the modern practice of laying cables direct in the ground the possible danger to men and horses due to a high voltage in the cable armouring is increased, but on the other hand, the chances of the armouring being naturally earthed at frequent intervals are also improved over those with cable laid on the solid system, unless the impregnated jute serving proves too effective an insulator. A number of joint boxes may happen to be in dry ground and provide no effective earth, and the question that is of some importance is this:—"Is it safe to assume that the armouring of cables laid direct in the ground is naturally earthed at frequent intervals of at least every few hundred yards?" If this cannot be proved to be the case, the safest method seems to be to earth the cable positively at frequent intervals through earth plates or cones, so as to reduce the path of a fault current between the fault and the nearest earthed point. Such earthing cannot cost much over £1 per point, and so it would seem advisable to make a practice of earthing every cable joint box.

London, *November 23rd*, 1923. **Reginald O. Kapp.**

"Strictly Home Office"?

After a brief respite, my letter of the 4th inst., published in the Electrical Review of the 9th inst., has now to withstand an icy blast from the polar regions; or is it Birkenhead?

In my last gentle zephyr, I stated that I had nothing but praise for "Artic Elements" as such. Now I have carefully tried to omit criticism of individual firms' products in the Press, and have confined myself to generalities with regard to complete board designs. Now, "Chairman of the Artic Fuse & Electrical Manufacturing Co.," also "Technical Adviser and Chief Designer of the Artic firm," very clearly exonerates "G.P.D." from all responsibility as to the design of the particular 4-way board to which I referred in my letter, and I have much pleasure in apologising to "G.P.D." for attributing to his fertile brain the abominable design of the particular board to which I referred, as I now learn that "all designs emanate from the patentee," &c., &c.! than would obtain if ordinary tinned copper fuse wires were used." Most certainly I was advised to use tinned copper wire with Artic elements. "No. 18 or No. 16 S.W.G. copper fuse wires, or strip of metal are used in elements." Anyway, what should be used? I fear "Chairman" has missed the point at issue. In my original letter published in your issue of October 26th, 1923, I stated that most makers would conform to my "fads." In fact my letters throughout have been a plea for uniformity and simplicity, combining strict conformity with Home Office requirements. In conclusion, I submit that without qualification, under all conditions, when the board door is open, all live metal should be shielded from casual or accidental human contact, apart from deliberate human contact. An advertisement appearing in the Electrical Review of November 23rd, 1923, indicates that one maker at any rate is beginning to agree with me.

W. E. Rogers, A.M.I.E.E.

London, *November 25th*, 1923.

The National Association of Radio Manufacturers and Would-be Factors.

We enclose herewith a letter received from the N.A.R.M., which we consider of special interest in view of the present political situation.

It is our endeavour, whenever possible, to stock goods of British manufacture, but in this instance we simply have no alternative but to look round for foreign markets, and as we are probably only one of many firms similarly treated, the cumulative effect is such that the problem of unemployment will never be solved whilst British manufacturers adopt this attitude.

We should have thought that an Association of this kind would have endeavoured to foster British trade, and that any factor whose standing was beyond question, and provided it was satisfied with his financial status, would be welcomed.

The moral of this is so obvious and is so constantly recurring that we rather feel we are ploughing the sand in raising this question again.

If this is a foretaste of what Protection means, we may all pray to be preserved from the British manufacturer and his inability to take advantage of the Home Markets when offered to him.

The Whitworth Electric Lamp Co., Ltd.
W. C. Hands.

London, *November 24th*, 1923.

[The enclosure states that the Committee of the N.A.R.M. declines to appoint the applicant, not in any way questioning his *bona fides*, but in pursuance of its policy to restrict the number of N.A.R.M. factors.—Eds. Elec. Rev.]

Keeping the Electrical Flag Flying.

Surely some of the statements contained in your leader under the above heading are, to say the least, misleading; I refer particularly to those passages which would lead one to believe that our factories are not working at their full capacity, and that the need of employing British workpeople to carry out contracts is still of first importance.

To judge from the attitude of several firms of repute and a casual glance through our delayed orders and correspondence files would, I feel certain, convince even the most sceptical as to the prosperous conditions existing in the manufacturing circles of the industry to-day.

Allow me to mention one or two examples. Take this one, for instance: An order was placed early in September for a

more or less standard piece of electrical apparatus with a firm specialising in its manufacture; according to the information received with the tender, delivery would be effected within three or four weeks. It happened that the article was required for a rather important job, and the time required for dispatch was a great consideration in placing the order; this fact was impressed upon the firm in question both by letter and through its representative direct. A reply was received in due course assuring us that the goods would be to hand within the specified time. No advise of dispatch having been received by the expiration of the period, further correspondence was entered into, resulting in a definite promise of delivery on the *n*th inst.; nothing came of this, however, and an explanation was politely but firmly asked for. A response forthcoming in the surprisingly short period of three days informed us that they *hoped* to get the article on rail on another old —th inst. (this might quite easily be mathematically interpreted as the *n*th inst. I suppose). Here we are, nearing the end of November and still hoping against hope for some sign of consideration; meanwhile, of course, our job is being held up. Here's another one (this is a firm with which my employers have done a good deal of business in the past); order placed third week in September (delivery as per quotation in six weeks) and this for standard catalogue stuff. Practically the same procedure is being gone through as in the instance cited above, and here again we are just as far off as ever from that elusive *n*th inst. There are one or two more, I see, dated the middle of October; one covers some simple wiring requisites and another meters. So far, *only part* of the last-named order has been executed and this after a request to dispatch as early as possible had been forwarded to the suppliers (to which communication, incidentally, we cannot trace having received a reply). There are a good many more, all "tarred with the same brush," but I will not take up your valuable space by elaborating further, as doubtless many more of your readers have been subjected to the same treatment, and to read of another's experiences is therefore no edification.

The irony of the situation has, however, yet to come; an order was placed with a firm of foreign interests on exactly the same date as the first case mentioned in this letter; six weeks' delivery was likewise asked for, but as a matter of fact, the apparatus was received and fixed in position exactly five days prior to the time stipulated for dispatch. Another firm (also importing from abroad) received a small order from us for instruments; they were to hand in the surprisingly short period of two weeks, notwithstanding the fact that four were asked for with the quotation. I know of instances where instruments (of a certain class) have been put on rail the day following the receipt of order by a firm of similar standing when the urgency of the matter has been made clear.

I am not denying that there are many British firms which would do the same, but my experience is that they are in the minority; and whilst some show every consideration and undoubtedly do their best in this most important matter of delivery, there is a good percentage who appear to treat the whole thing with an indifference that, in view of the conditions at present prevailing, seems incredible. It would be exceedingly interesting if some of them could be persuaded to inform us through your columns as to the exact reason for these annoying delays, which are exceedingly detrimental to the pocket and temper and are bound to react upon a wide field in the industry. Let them give us the exact truth, not the "eye-wash" that we receive individually in response to our petitions for a reasonable dispatch, some of which the office boy has a job to keep a straight face over.

I would conclude by saying that I have for some years been entrusted with the duties of sending out inquiries and dealing with the ordering of material, &c., by more than one undertaking, where the necessary "cash" has in nearly every instance been forthcoming at the end of the month following delivery, but it makes no difference. Now, Sir, where's the "snag"?

Hadsum.

November 25th, 1923.

A Non-Technical Explanation of "Power Factor."

The great extensions in electricity supply which are now taking place, and the increased length of cables through which electrical energy is being transmitted, together with the high capital cost of generating plant, have combined to bring the question of power factor very much to the fore. Hardly a paper is written on subjects connected with the transmission, distribution, use, and measurement of electrical energy which does not deal at length with this important subject.

Notwithstanding the mass of literature which is available from the technical point of view, it is nevertheless difficult, if not almost impossible, to give a satisfactory explanation of power factor to a non-technical user of electrical energy, and after an attempted explanation, the consumer more often than not comes to the conclusion that power factor is a dodge, cunningly invented and kept a mystery by the electrical fraternity for the purpose of extracting more money from him than the supply authority is entitled to.

The problem of finding a simple explanation which will satisfy the average user is a difficult one. It is, however, a matter of considerable importance to supply authorities and to those of us who are interested in the manufacture of relevant apparatus.

In view of the difficulty of the problem, it occurs to me that the best method of seeking a solution would be to appeal to the profession as a whole, and to offer prizes for the best explanations.

If, therefore, you will extend the hospitality of your columns, I should like to offer, on behalf of my company, prizes of £5 5s., £3 3s., and £2 2s., for three explanations of power-factor calculated to convince a non-technical power consumer of the propriety and fairness of supplying energy on a basis of charging that is dependent on the power-factor of the installation.

The offer of prizes is subject to the following conditions:—

(1) The solutions to be addressed to "Power-Factor," c/o. The Electrical Apparatus Company, Ltd., Vauxhall Works, South Lambeth Road, London, S.W.8.

(2) Solutions should not exceed 1,200 words in length, and must be received by the last post on December 31st, 1923.

(3) An independent adjudicator will be appointed to judge the competition, and his decision must be accepted as final.

R. Amberton,
Director.
Electrical Apparatus Co., Ltd.

London,
November 23rd, 1923.

The Cost of Living in India.

I am pleased to be able to reply to your correspondent "W.E.G." regarding the cost of living in Bombay or Calcutta, as I have just returned to England after spending three years in the former city.

I am afraid that he will find it absolutely impossible to live on Rs.500 per month, unless quarters are provided, and, even then, it will be a tight fit, with very little for other than necessities.

In general, it may be said that no married man should dream of going to India on a salary less than Rs.1,000 per month, unless it be in the interior, where living is very much cheaper.

Should "W.E.K." desire any further information, I shall be glad to supply it if he will communicate with me.

H. Marshall.

London, *November 25th*, 1923.

[Since the above letter was received, several other correspondents have kindly offered to give full information on the subject, based on personal experience; on behalf of "W.E.K." and others interested in the matter, we cordially thank them all. Those who give particulars are in general agreement with the writer of this letter. Readers who desire to be put in touch with these gentlemen are invited to write to us in the first instance.—Eds. Elec. Rev.]

The Postmaster-General and Electric Power and Lighting Undertakings.

I notice in Mr. Bartholomew's letter, and that of "A.J.S.," in your issue of November 16th, references to my letter of the 2nd instant on the above subject.

In the first place, I hope you will allow me to say that Mr. Bartholomew's intervention from the Engineer-in-Chief's Office, G.P.O., is a matter of congratulation. I hope it heralds a new era of reasoning matters out to replace the bad old times of autocratic regulations, based on prejudice rather than experience and scientific progress.

While Mr. Bartholomew states at the outset that he had decided to turn his back "even on the tempting bait of Mr. Fennell's letter" of November 2nd, he succumbs to that temptation at the end and attacks what one can only conclude he considers to be the only one with a blunt hook, or with none at all, concealed in it.

I am very interested to hear that the G.P.O., after talking for many years vaguely about induction, and having found that spiralling will counter it, now raises the question of static charge.

However, the "high" pressure which will exist on the line to which the Postmaster-General objects is one which did not, I think, call for any particular consideration of static effects, and that is why I ignored that aspect. The line will consist of a live wire at only 3,300 volts above earth, with two earthed wires immediately under it, *viz.*, the return wire and the earth wire. The average distance between this line and the G.P.O. line will be something over 40 ft., and the length about a mile. On page 758 of your issue of November 16th, there is an article "Rural Distribution of Electricity with Return by Earth." It is there stated that some experiments were carried out in 1906—7 at 11,000 volts, which proved that at a distance of only 30 ft. approximately, and for a length of 2½ kilometres, there is a "practically negligible" disturbance from presumably combined static and magnetic induction. A proportion sum would show that the static induction only of a 3,300-volt line at nearly twice the distance from

the G.P.O. line for a much shorter length, having two earthed wires within a yard of it, would have a disturbing effect considerably less than "practically negligible."

A line which is seriously affected by static charges is not suitable for a public telephone service; it is at the mercy of atmospherics, and is the cause of inconvenience and loss to the public. It is obvious that the methods which will ward off variable atmospherics will easily deal with the calculable static induction from a power line at a fixed frequency and a definite p.d., and at a constant distance. I have no doubt that this question of static induction will become important when, as is inevitable, 33,000-volt lines become common in this country, and for that reason the G.P.O. should at once investigate shielding devices. We power engineers cannot accept the suggestion that if unprotected or unshielded telephone lines are affected statically, power lines shall not be erected near them.

With regard to the suggestion by "A.J.S.," that unless I am "an authority" on the subject my statements should not be accepted without inquiry, I would go further and say that having in view the difficulty of defining an "authority," and knowing that to "err is human," any unproved statements, whether made by me, by Mr. Bartholomew, by the Engineer-in-Chief of the G.P.O., or by the Archbishop of Canterbury, should be rejected if they do not agree with practice. We have recently heard of the case of the late Prof. Hughes, who bowed to the voice of "authority" in the eminent persons of Professors Huxley and Forbes. He lost the credit of the discovery he had made, and the world had to do without wireless for many years.

The public, I am sure, having a need for cheap and good telephony, and cheap power, would prefer that any difficulties be discussed, and made the subject of scientific investigation, and they do not approve, I am sure, of *blighting* regulations and objections drawn up by anonymous members of the G.P.O. staff in the name of that great authority—the Postmaster-General—to be imposed on the newer, but more important, branch of electrical engineering. If, therefore, the Postmaster-General and his staff cannot construct their lines so that they are reasonably free from static disturbance, it will be open, I presume, for a Committee of the Institution of Electrical Engineers to be appointed to assist them. We cannot accept the position that the Postmaster-General is the only authority on telephony, nor can we allow the telephone officials to hamper other and equally important utility services because they are not able or willing to improve their own methods.

W. Fennell.

Northwich, *November 20th*, 1923.

Working Conditions in America.

With reference to my query regarding the prospects of British university engineering graduates in the United States (October 19th issue), and the very useful information given by Mr. Charles M. Whitfield, of Schenectady, New York, U.S.A. (November 16th issue), may I crave a little further space to express appreciation, and the particular thanks of interested non-posted graduates, including myself, to Mr. Whitfield for his most valuable and interesting information.

J. R. Evans.

Bangor, *November 20th*, 1923.

An American Station on One Valve.

Presuming that "J.S.'s" letter, in your issue of the 16th inst., is not an advertisement for the firm he mentions, I would respectfully suggest that it was not he who was receiving America, but that someone ("N") in the neighbourhood with an "N"-valve set was receiving it, and that the scrap of conversation that "J.S." heard was radiated from "N's" aerial, which was oscillating for a few moments. When "N" adjusted his reaction, the American station "apparently" (*sic*) closed down, as far as "J.S." was concerned.

I believe this is the explanation of all these marvellous one-valve feats.

D. V. Onslow.

Cricklewood, *November 20th*, 1923.

Letters Too Late.—Letters have been received, too late for insertion this week, from Prof. W. Cramp, Mr. J. W. Fawcett, and Mr. H. Moss.

BUSINESS NOTES.

Bankruptcy Proceedings.—R. Billington, electrical contractor, 163, Walker Street, Kingston-upon-Hull.—Receiving order made November 17th on debtor's own petition.

H. Boocock (Hardwick & Co.), electrician, 28, New Lane, Selby.—Receiving order made November 19th on debtor's own petition. First meeting, December 6th, at the Official Receiver's Office, 24, Bond Street, Leeds; public examination, December 18th, at the Court House, Leeds.

C. A. Carpenter, electrical engineer, 4/5, Mason's Avenue, Basinghall Street, E.C.—Application for discharge to be heard at Carey Street, W.C., on December 12th.

G. J. Hogg (F. Hogg & Co.), electrical engineer, 66, Waterloo Road, Smethwick.—Trustee, Mr. T. Easton, Official Receiver, 191, Corporation Street, Birmingham, released November 16th.

W. H. Vevers (W. H. Vevers & Son), builder and decorators, sanitary and electrical engineer, 91, King Street, Maidenhead.—First and final dividend of 10¾d. in the £ payable December 3rd at 10, Serjeants' Inn, E.C.

Emmett & Co., 249, Goldhawk Road, Shepherd's Bush, W., electrical engineers, &c.—The first meeting of creditors in this case was held on November 23rd, before Mr. Walter Boyle, Senior Official Receiver at the London Bankruptcy Court. It appeared that no one surrendered to the proceedings, and consequently no statement of affairs had been lodged. The Chairman reported that the receiving order was made on November 12th on the petition of Pinchin, Johnson and Co., Ltd., and Frank Mayle & Sons, Ltd., who alleged as the act of bankruptcy the non-compliance of the debtor with the requirements of a statutory bankruptcy notice. His (the chairman's) inspector had attended at 240, Goldhawk Road and found that the premises consisted of a lock-up shop, nobody being there. He was, however, informed that a man named Southcott had traded there and had been seen to call occasionally, lock up the place and go away. The landlord's name was not known and the debtor's private address could not be ascertained. Mr. Southcott had asserted that one Robert Emmett constituted the firm of Emmett & Co., and that Emmett ceased to carry on business at that address in July last, the bailiff removing all his good under an execution. Part of those goods had belonged to him (Scuthcott). The sale was effected in September and there were now no papers, books, or other property on the premises belonging to Emmett. Southcott had added that he was a sailor and was going to sea and he denied having been a partner in the firm. The Chairman remarked that it sounded to him as if Emmett were an imaginary person, but if the creditors decided that the Official Receiver should apply to adjudicate bankrupt Robert Emmett, trading as Emmett & Co., then any trustee appointed could ask for a private sitting for the examination of Southcott. The meeting passed a resolution for bankruptcy and appointed Mr. A. E. Quaife, I.A., 155, Fenchurch Street, E.C., as trustee to administer the estate.

Henry Edward Robson Roose, 103, High Holborn, and Denmark Avenue, Wimbledon.—The public examination of this debtor was held on Tuesday at the London Bankruptcy Court, the accounts showing liabilities £6,314, against assets valued at £120. Replying to Mr. D. Williams, Official Receiver, the debtor stated that from 1893 to 1902 he was a member of the London Stock Exchange, but in the latter year was declared a defaulter. In 1906 he entered the employment of the Amalgamated Radio Telegraphic Co., Ltd., of which he later became secretary; on the liquidation of that company his services were retained by the liquidator until 1911. He next assisted in the management of an electrical business, which in 1913 was transferred to the International Electric Co., Ltd.; he was appointed managing director at a salary of £1,100 per annum, and held that position until last April, when he resigned owing to a breakdown in health. Witness attributed his failure to his having accepted liabilities for cash advanced to others and interest thereon without receiving any consideration for doing so, and to excess of expenditure over income. The examination was concluded.

D. Bould, motor and electrical engineer, Burn Croft Birchencliffe, Huddersfield.—First dividend of 3s. 2½d. in the £, payable November 29th, at the Official Receiver's Office, 12, Duke Street, Bradford.

R. E. Hughes and R. McL. Alexander, trading as R. E. Hughes and Hughes & Alexander, house furnishers and electrical and wireless engineers, 129, Brockley Rise, S.E., and 51, Honor Oak Park, S.E.—Receiving order made November 23rd on debtors' own petition.

R. J. Littler (wireless company's agent), Hill View Stores, Rossmore, Upper Parkstone.—First meeting, December 7th; public examination, December 7th, both at the Law Courts, Bournemouth.

P. Rukin, electrical engineer, Manchester Road Station, Bradford.—Last day for proofs for dividend December 11th. Trustee, Mr. J. Draper, 69, Swan Arcade, Bradford.

Company Liquidations.—Wireless Installations, Ltd., 81, Turnmill Street, E.C.—A compulsory winding-up order was made against this company on October 16th upon the petition of Rotax Motor Accessories, Ltd., and on November 22nd the statutory first meeting of the creditors and shareholders were held at the Board of Trade Offices, Carey Street, W.C. Mr. G. D. Pepys, Official Receiver, reported that the company had a very short innings. It was incorporated on October 6th, 1922, with a capital of £100 to carry on the business of manufacturing, assembling and sale of wireless receiving sets, &c., the first directors being Mr. H. C. Phillips and

Mrs. B. A. Phillips, and the business was carried on satisfactorily until April or May, 1923, but then leading articles appeared in certain sections of the Press which caused uncertainty to arise in the minds of would-be purchasers or users of wireless receiving sets, as to whether broadcasting would continue on such a basis as the general public could afford. According to Mr. Philips, the general effect of these articles was to discourage persons to such an extent from buying that an almost immediate slump was experienced in the trade. That curtailed the company's output, and a great many sets previously manufactured and sold were thereupon returned to the company owing to alleged defects. Those defects had to be put right, if possible, and the company had to bear the cost of that and of re-delivering the sets to the customers. Mr. Phillips had admitted that probably there were a good many defects in the sets manufactured, but that, he said, was general throughout the trade, and when the boom was at its height early in 1922, retailers who purchased sets were only too glad to get them, and were quite prepared to remedy the defects themselves, but after the slump took place in May, 1923, retailers took the opportunity of returning defective sets to the company, and thereby a loss arose. The defects were partly due to lack of skilled labour, and partly to imperfect materials supplied to the company. The trading accounts showed net sales (after deducting £2,109 for loss to the company on sets returned) of £15,646 for the whole period of the company's existence; there was £900 stock in hand at the date of the winding-up order, making a total of £16,546; against that had to be placed £15,450 in respect of materials purchased and wages, leaving a balance of £1,096 to represent the gross profit. That did not take into account the overhead charges, and only showed 6 per cent. profit on the sales, obviously a very poor result. The two directors found it necessary to go to the Continent for the purpose of buying various wireless accessories; they bought detector valves in Holland and headphones and loud speakers in France; they opened up selling agencies abroad, and returned travelling expenses in connection with that visit at £120. Debentures for £600 bearing 7 per cent. interest and constituting a first charge on the assets of the company were issued to Mrs. Phillips in April last in consideration of cash advanced for its purposes, and in August upon certain creditors pressing for payment of their accounts, Mrs. Phillips obtained the appointment as receiver of Mr. John S. Bird, C.A., 36-8, Victoria Street, Westminster. That gentleman carried on the business for a short time with a view to selling it as a going concern, but had now closed it down, and had disposed of the stock for £300. The failure was attributed by Mr. Phillips to the slump following the appearance of the before-mentioned articles in the Press, also to the company having been handicapped by lack of skilled labour, but having regard to the very small gross profit shown by the accounts, the company must have failed sooner or later, slump or no slump. The draft accounts filed by the liquidator showed unsecured liabilities £2,954, in addition to the debentures for £600 plus £19 for interest. The assets were valued at £611, which sum, if realised, would not be quite sufficient to discharge the debenture debt; consequently there could be no prospect of any dividend for the unsecured creditors or any return for the shareholders. The creditors present expressed a hope that the Official Receiver would make full inquiry as to the validity of the debentures, and certain of them complained that Mr. Phillips had kept them at bay when they attempted to get payment. Mr. Pepys said the debentures would certainly be very carefully scrutinised, and all the circumstances attending the history and trading of the company would be the subject of the fullest inquiry. Mr. Phillips had been required to attend that meeting, but had not put in an appearance for reasons best known to himself. The liquidation was left in the hands of the Official Receiver.

ELECTRIC WELDING CO., LTD.—Winding up voluntarily. Liquidator, Mr. E. Hayes, 28, Basinghall Street, E.C. A meeting of creditors was called for to-day at the liquidator's offices. Particulars of claims by December 31st.

MIDLAND RUBBER CO., LTD.—Winding up voluntarily. Liquidator, Mr. R. W. Rutledge, 131, Edmund Street, Birmingham. Meeting of creditors December 3rd, at 10, Newhall Street, Birmingham.

GOODALL ELECTRIC CO., LTD.—A meeting of creditors was called for November 26th. Particulars of claims to the liquidator, Mr. J. G. Hurst, 13, Union Court, Liverpool, by December 20th.

ABBOTT, ANDERSON & ABBOTT, LTD.—A meeting of members is called for December 28th at Thames House, Queen Street Place, E.C., to hear an account of the winding-up from the liquidators, Messrs. E. Moore and H. Sharp.

ARDEE ELECTRIC CO., LTD.—A meeting of creditors was called for the 26th inst. Liquidator, Mr. J. Sedgwick, 2, Church Lane, College Green, Dublin.

RADYR ELECTRIC CO., LTD.—Particulars of claims to the liquidator, Mr. H. W. C. Evans, 4, Park Place, Cardiff, by December 31st.

NUNEATON ELECTRICAL CONTRACTING CO., LTD.—A meeting of members is called for December 31st at the offices of Messrs. Clay, Russell & Co., Newdegate Street, Nuneaton, to hear an account of the winding-up from the joint liquidators, Messrs. P. Russell and A. Cripwell.

GOODALL ELECTRIC CO., LTD.—Mr. J. G. Hurst, accountant, of Liverpool, has been appointed liquidator in succession to the late Mr. G. Turner.

Private Arrangements.—WILLIAM LINDSAY & CO., electrical engineers and wireless dealers, Holm Street, Glasgow.—A meeting of creditors was held recently at the office of Mr. Wishart, 138, Bath Street, Glasgow, when a statement of affairs was presented, which showed liabilities of £1,566, while the assets amounted to £407, leaving a deficiency of £1,159. The assets comprised stock £257, and book debts £204, from which preferential claims of £54 had to be deducted. There was also a fully-secured creditor for £50, who held security of a like amount. It appeared that the firm started trading in March, 1922, the partners being Mr. J. Rule and Mr. W. Lindsay. The commencing capital was £70, of which £50 was provided by the former and the balance by the latter. During the first year's trading a profit of £192 was made, but since then there had been a loss of £150. The deficiency was accounted for by the personal drawings of J. Rule, £283, W. Lindsay, £411, loss on stock, £159, loss by bad debts, £50, loss on sale of motors, £100, expenses of running motors, £206, and trading loss to date, £150. Debtors were called into the room and questioned as to their deficiency, but they could give no further explanation of it. An offer was made of 5s. in the £, payable in cash on acceptance by all the creditors, and 1s. per month for the next three months, these three payments being fully secured to the satisfaction of a committee of inspection consisting of the three principal creditors. After discussing the position, the creditors decided to accept the offer, as it was pointed out that in the event of the estate being dealt with under a deed of assignment or in bankruptcy, the dividend would not amount to more than 1s. or 2s. in the £. The following are creditors:—

	£		£
Cable Accessories Co., Ltd. ...	222	Wm. McGeoch, Ltd.	41
Electric Lamp Factor Co., Ltd.	117	British Thomson-Houston Co., Ltd.	43
Foster Electric Co.	182	British Electric Co., Ltd. ...	30
General Electric Co., Ltd. ...	111	Enfield Cable Works, Ltd. ...	32
Z Electric Co., Ltd.	96	J. & W. B. Smith	26
W. A. C. Smith	58	Fuller Metal Wire Works ...	23
John Fothringham	50	Metallic Seamless Tube Co. ...	93
Siemens Bros. & Co., Ltd. ...	46	Paterson & Service	22
H. Joseph & Co.	44		
Wm. Geipel & Co.	42		

GEORGE WILSON CLARKSON, trading as Clarkson & Co., wireless dealer, &c., Biggar, Lanarkshire.—The creditors interested herein were called together recently at Glasgow. A statement of affairs submitted showed liabilities £2,267, of which £1,204 was due to the trade, while there were cash creditors for £1,062. The assets consisted of stock-in-trade and spares, £279, expected to realise £186; wireless apparatus, £112, expected to produce £75; workshop tools and equipment, £59; book debts, £125; and a lorry valued at £50, making total assets £548, from which had to be deducted £192, leaving net assets of £356, or a deficiency of £1,811. It was stated that the cash creditors were Mr. Alexander Clarkson for £915, and the bank for £547. The latter held security in the form of reversion oi property valued at £400. It was understood that in the event of the property not realising the amount at which it was valued, the bank's claim would be increased accordingly. It was reported that the debtor commenced business in January, 1920. He had no capital of his own, but borrowed £1,100, of which £600 was lent by his mother, but she is not ranking on the estate in respect of that amount. The accountant stated that the debtor's books were insufficient to enable a trading account to be prepared, but he had been able to ascertain that for the year to December, 1922, the receipts had amounted to £3,362, while against that the payments were £4,352. The debtor had no offer to make, and it was decided that the estate should be realised under a trust deed in favour of Mr. McMillan, of Glasgow, as trustee. A committee of creditors was also appointed to act with him. The following are creditors:—

	£		£
Industrial Guarantee Corporation	201	Accessories (Edinburgh), Ltd. ...	20
Meir & Baxter	321	Robert Boa	19
General Electric Co., Ltd. ...	225	Surridge Patents	12
Lister & Co.	130	Malcolm & Allan	11
F. M. Milligan	67	Creditors under £10	136
Taylor & Melville, Ltd.	23		

L. SPREADBOROUGH, electrician and wireless dealer, 14, Frith Street, Soho, and 539, High Road, Leytonstone.—A further meeting of the creditors of the above was held on November 20th at the Holborn Hall, Gray's Inn Road, London, W.C. According to the statement of affairs, the liabilities totalled £361, while the debtor had various contracts in hand, and had offered a composition of 5s. in the £. The meeting was adjourned with a view to an offer of not less than 10s. in the £ being forthcoming. It was now reported that the debtor had been unsuccessful in obtaining sufficient support to enable him to pay 10s. in the £, but had been able to obtain assistance which would allow him to pay 7s. 6d. in the £ by 4s. in cash and 3s. 6d. in three months, and guaranteed. The representative of the largest creditors stated that they were not disposed to accept 7s. 6d. in the £, and it was eventually decided that the debtor should be granted further time within which to submit a composition of 10s. in the £. It was understood that the solicitors would inform the creditors whether the composition demanded would be forthcoming.

C. R. SMALL, 5, High Street, Clacton-on-Sea, electrical and wireless dealer.—Messrs. Poppleton, Appleby & Hawkins, accountants and auditors, of 4, Charterhouse Square, London, E.C.1, report that the above estate has now been wound up by Mr. E. H. Hawkins, the trustee, under the terms of the deed of arrangement, and that they have issued notice of payment of a first and final dividend of 20s. in the £.

Receiver Appointed.—Mr. G. T. COLEMAN, 13, Temple Street, Birmingham, has been appointed receiver of Holmes and James, Ltd., on behalf of the debenture holders.

Dissolutions of Partnership.—ADAMS, HUGHES & Co., electrical engineers, 111, Clarendon Street, Hulme, Manchester.—Mr. A. Adams and Mr. W. G. Hughes have dissolved partnership. Mr. Hughes, of 19, St. Bees Street, Moss Side, Manchester, will attend to debts.

H. LEE & Co., tire repairers, motor mechanics, and electrical engineers, The Talbot Garage, Lytham, Lancs.—Messrs. H. Lee and D. Forshaw, jun., have dissolved partnership. Mr. Lee will attend to debts.

UNITED ELECTRIC CO., electrical engineers, 55, Low Briggate, Shipley.—Mr. H. D. Jackson and Mr. C. Benns have dissolved partnership. Debts will be attended to by Mr. Benns, who will continue the business under the same style.

Trade Announcements.—Mr. T. C. ALEXANDER has started business as an electrical and mechanical engineer for the sale of plant, cable, accessories, &c., at 67, Hope Street, Glasgow, under the name of Turnbull Alexander & Co.

MR. C. A. CLARKE, power plant company representative, has removed to 26, Seymour Hill, Higher Crumpsall, Manchester. Telephone: "990 Cheetham Hill"; telegraphic address: "Poplaco, Manchester."

Messrs. L. MCMICHAEL, LTD., radio engineers, of London, have opened a branch business at 5, Yelverton Road, Bournemouth.

THE SURREY WHOLESALE ELECTRICAL CO., LTD., Croydon, states that there is no truth in the rumour that it is in any way connected with a firm of contractors. Mr. W. E. McClelland takes no active part in the Electrical Maintenance Co. of Wallington, of which his brother, Mr. F. C. McClelland, is the proprietor.

Catalogues and Lists.—THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—An illustrated booklet dealing with shop-window and commercial lighting by means of "X-Ray" reflectors. Also a pamphlet describing "B.T.H." thermostatic metal for various purposes.

THE EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4.—A price list of wires and cables of numerous types, jointing materials, and accessories.

Messrs. A. H. HUNT, LTD., Tunstall Road, Croydon.—Catalogue No. 50a, containing illustrations and prices of dry batteries, accumulators, loud speakers, telephones, measuring instruments, valve holders, and other radio and electrical materials and accessories.

Messrs. ACKROYD & BEST, LTD., Beacon Works, Morley, near Leeds.—Catalogue S.7, dealing with artistic and plain glassware, metal stampings, machined parts, miners' and watchmen's lamps, &c. Fully illustrated.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—The "Benjamin Bulletin" for November, containing notes on the lighting of factories, particularly with regard to the employment of "Benjamin" reflectors.

Messrs. RUSTON & HORNSBY, LTD., Lincoln.—A pamphlet illustrating and describing "Thermax" boilers with evaporative capacities from 400 to 2,850 lb. of water per hour.

THE HENDON ELECTRIC LAMP CO., 104, Southampton Row, W.C.—A price list of "Hendon" lamps of various sizes and voltages.

Messrs. LESLIE DIXON & Co., LTD., 9, Colonial Avenue, Minories, E.1.—Illustrated pamphlets, advertising portable drills, telegraph recorders, wavemeters, measuring instruments, &c.; and a price list of radio accessories and materials.

THE CAMBRIDGE & PAUL INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A mailing card illustrating a contact pyrometer equipment.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4. — Catalogue No. 66, illustrating numerous examples of "Moonstone" glassware for use with gasfilled and vacuum lamps. With separate price list.

Messrs. HERBERT MORRIS, LTD., Loughborough.—Booklet No. 81 (E 281) illustrating and describing a variety of goods-handling gear, including electric hoist blocks, travelling cranes, and elevators.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C.4.—Leaflet No. 251 R, describing the "Super" box for use with the Henley wiring system.

ELECTRICO, LTD., 139, Bournemouth Road, Parkstone, Dorset.—An illustrated catalogue of electric geysers, kettles, stoves, grills, heaters, and other electrical appliances.

Messrs. MAY & PADMORE, LTD., Tyseley, Birmingham.—An illustrated price list of "Maymore" electric fires of various patterns.

THE D.P. BATTERY CO., LTD., Bakewell, Derbyshire.—A booklet advertising "short first charge" batteries.

Brazilian Trade in October.—In the course of an article on the trade of Brazil during October, *Commerce Reports* says that the demand for smaller electrical apparatus was fair, but in the heavier classes prices declined, and competition was very keen with imports from Italy increasing. Imports of electrical goods at Santos during the month included 25,711 kilos from Germany and 9,840 kilos from England.

Book Notices.—"The Essentials of Transformer Practice," by E. G. Reed. Pp. x+265; figs. 124. London: Sir Isaac Pitman & Sons, Ltd. Price 12s. 6d. net.

"Hydraulics," by E. H. Lewitt. Pp. vii+261; 133 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 8s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers. Vol. xlii, No. 11. November, 1923. New York: The Institute. $1.

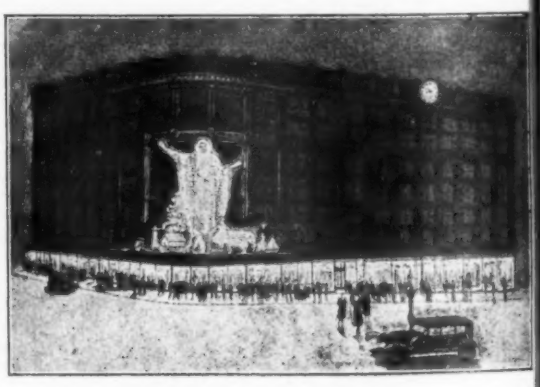
New Works Contemplated. — A correspondent of *The Times Trade and Engineering Supplement* states that a deputation from Carmarthen has waited upon the Transport Ministry in connection with the propcsed light railway from Llandilo to Lampeter. The scheme is estimated to cost £160,000. Contributions to the extent of £80,000 are promised, including £40,000 from the Carmarthen County Council, and it is desired that the Ministry should contribute the balance. It is announced that the Government is prepared to give guarantees under the Trade Facilities Act in connection with the raising of the capital required.

It is believed that the scheme for the great dam at Trawsfynydd, Merionethshire, and other works will give employment to about 2,000 men for three years at least. In addition to the generating plant, the scheme involves the construction of some 600 miles of transmission lines to supply the whole of North Wales and part of Cheshire. One line will be about 100 miles long, and will carry current as far as Crewe. It is hoped that the provision of power will enable new industries to be established throughout the area of supply, and in addition help to develop existing mining and other enterprises. It is hoped to supply electricity at 1¼d. per kWh.

Valencia Contracts.—*The Times Trade and Engineering Supplement* states that the contractors for the construction work and pumping plant for a new power station at Valencia are Messrs. Armstrong, Whitworth & Co., while the British Thomson-Houston Co. is responsible for the electrical portion and Messrs. Babcock & Wilcox for the boilers. The initial installation consists of two turbo-generators of 7,500 kW each, with provision for a third set of 10,000 kW.

Indian Industrial Exhibition.—The third of the series of exhibitions inaugurated by the Indian Industries and Trade Developing Syndicate, Ltd., of Karachi, will have for its venue Baroda, the two previous exhibitions having been held at Karachi and Surat. The exhibition, which will be open from December 16th to 31st, will be under the patronage of his Highness the Maharaja Gaekwar's Government. The executive has issued an alluring programme which should attract a large number of spectators to the exhibition.—*Indian Engineering.*

Large Christmas Signs.—Messrs. Lewis, who have large "department" stores in Liverpool, Manchester, and Birmingham, have erected a large electric sign on each of their establishments. The Liverpool building is illustrated in the



MESSRS. LEWIS'S BUILDING, LIVERPOOL.

accompanying illustration, from which it will be seen that the sign consists of a huge "Santa Claus" outlined in "Osram" lamps of many colours. The figure is about fifty feet in height and embodies 4,000 lamps.

The electrical installation in Messrs. Lewis's buildings was fully described in our issue of November 9th.

Lead Report.—Messrs. James Forster & Co. report under date November 24th: "Closing prices yesterday were £30 5s. for November and £28 10s. for February, against £30 5s. and £27 5s. respectively at the end of last week. The feature of the market this week has been the steady demand for lead for forward delivery. Prompt lead continues scarce and £31 has been freely paid this week by consumers. Consumption in the last two months has been very heavy and far above anything anticipated even three months ago. The electrical trades are also very busy, so that it is safe to say that consumption is now on the level of 18,000 tons per month."

New Belgian Company.—There has been registered at Brussels (129-131, Rue Sans Souci) the Ateliers de Constructions Electriques. The Belgian Electrical Co., with a capital of 200,000 fr., for the sale of electrical material, the representation of foreign firms and the exploitation of patents.

The Western Electric's Forty Years.—To celebrate its fortieth year the Western Electric Co., Ltd., has produced a pictorial souvenir containing a history of developments during the company's "lifetime." Naturally the volume deals principally with telephonic progress, for the parent American company obtained, in 1882, the sole manufacturing rights of the American Bell Telephone Co., and since that time has been the foremost in the developing of telephony and its later branches—wireless telephony and the "public address" system. The illustrations are very profuse and clear, conveying an excellent idea of the present state of the communication art. Among the "historical" pictures we are interested to see a reproduction of a woodcut published in the Electrical Review in 1884. Automatic telephony, traffic control systems, relay systems, simultaneous telephony and telegraphy, and many other subjects receive attention. A small section deals with power cable development, and the evolution of the thermionic valve is also touched upon. The souvenir is being presented to all the employés of the company and many of its friends

E.D.A. Activities.—A variety of ideas is contained in a bunch of pamphlets recently received from the headquarters of the British Electrical Development Association. One pamphlet is a reproduction of an article by Mr. L. L. Robinson, of Hackney, which deals with the use of electricity in the small home—a subject upon which the author is well informed. E.D.A. No. 371 is a series of five advertisements on electric cookery—the use of ovens, grills, &c. Another publication (E.D.A. No. 379) is addressed to suppliers of electricity and points out the advantages of a two-part tariff. A discussion between Mr. Beauchamp and Mr. W. M. Mason (of the British Commercial Gas Association) on the subject of electricity *versus* gas for cooking is reproduced from the *Leicester Mail*. Other leaflets deal with the use of standard plugs, the "electrical origin of fire" *canard*, shop-window lighting after business hours, &c.

Stoker Contracts.—Travelling grate stokers have been provided for the following electricity stations by the Underfeed Stoker Co., Ltd.:—Grimsby, 6; Hull, 2; Newport (Mon.), 2; Falkirk, 2; Dalmarnock, 8; Central Electric, 6. Other contracts for travelling grate and other stokers include a number for Japan, China, Montreal (tramways), &c., while ash conveyors have been supplied to the South Wales Power Co., and air heaters to the Central Electric station.

Threatened Strike of Electricians.—*The Times* states that trouble has arisen between the Electrical Trades' Union and contractors for the electrical installation at Somerset House, and the men concerned have threatened to withdraw their labour unless a settlement is reached. The question at issue turns on the employment of non-union labour. Negotiations are proceeding between the parties which, it is hoped, may lead to a settlement of the trouble.

Unemployment.—The number of persons on November 19th recorded on the live registers of the employment exchanges in Great Britain was 1,234,700. This was 9,704 less than in the preceding week, and 251,178 less than the figure recorded on January 1st, 1923.

The statistics for the County of London, as compiled by the L.C.C. Special Committee on Unemployment, show that the total number of unemployed in the area on November 12th was 133,557. This appears to be about the average for the year.

The Boilermakers' Lockout.—The ballot of the Boilermakers' Society upon acceptance or refusal of the terms of settlement arranged at Edinburgh resulted in a substantial majority in favour of the agreement, and work was resumed on Monday.

A Shop-window Attraction.—One of the outstanding publicity features at the recent Wireless Exhibition at the Waite City was the large illuminated model of the "R.I." transformer. The interest which this attracted has led the manufacturers, Radio Instruments, Ltd., to have a number of similar models built, and these will be available to prominent dealers in various parts of the country for window display during the Christmas season.

Central Steam Heating at Winnipeg.—According to a pamphlet that has been issued by the Winnipeg Hydro-Electric System, it is proposed to build a central steam-heating system in conjunction with the steam stand-by plant which is now being installed. The area to be heated will be on the west side of the Red River, with a radius of about one mile from the plant. At the present time the stand-by plant is designed to run on oil. If the present proposal materialises, it will be adapted to the use of pulverised lignite from Saskatchewan which, it is estimated, can be delivered to Winnipeg for about $4.50 per ton.

Interested firms who are desirous of offering plant or materials of British manufacture in connection with these proposals, in the event of the scheme being adopted, should communicate with the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1 (quoting Reference No. 12595/E.D./E.P.).

Australian Industries.—Mr. Theodore has informed Mr. Page (Queensland) that he is unable to accept the British Government's offer of financial assistance to carry out development works necessitating the purchase of material in Great Britain. He points out that the requisite material, particularly steel rails, locomotives and machinery, is obtainable in Australia at satisfactory prices. The Government does not consider it good policy to place orders in England to the detriment of Australian manufacturers.—*Exchange Telegraph* (Melbourne).

Smokeless Fuel Production.—A circular has been sent to the shareholders of Low Temperature Carbonisation, Ltd., informing them that capital has been found for the further extension of the Barnsley "Coalite" works to provide for an increase of 3,000 tons per week in the output. The company is receiving assistance from the Trades Facilities Committee.

Higher Tariff Desired by Australian Manufacturers.—The *Argus* says that a report presented to the annual meeting of the Associated Chambers of Manufacturers of Australia at Perth stated that many applications had been made to the Tariff Board in the interests of Australian manufacturers. On all occasions the board had given sympathetic consideration to the requests submitted, and, when justified, had granted them, but its powers had been limited. The necessity for increased tariff protection on many lines had been demonstrated. In some cases the Tariff Board, after a thorough investigation, had submitted its report to the Minister, but the Ministry had failed to give effect to any readjustment of the tariff duties, because Parliament had not the time to deal with the report. The necessity for tariff revision is shown by a comparison of the figures for the last two financial years of the Commonwealth, as follows:—

For the year ending June 30th, 1922, the importations into Australia were valued at £103,066,436.

For the year ended June 30th, 1923, they amounted to £131,808,673.

The 1921 tariff was declared in some quarters to be an unreasonably high one, but this is not borne out by the recorded facts.—*Reuter's Trade Service* (Melbourne).

Foreign Competition.—With reference to the report recently reproduced here regarding contracts secured from Russia by the Metropolitan-Vickers Electrical Co. and other British concerns, *The Times* in its editorial City Notes makes the following comments:—

"It has been reported from Russia that Vickers have secured a Russian contract of some magnitude. The grounds for these reports appear to be the negotiations which have been proceeding between the Soviet Government and Vickers' subsidiary, the Metropolitan-Vickers Electrical Co. for the supply of certain electrical apparatus. These are still proceeding, but we learn that the company has definitely contracted to supply transformers and switchgear for electric power stations which are being built in Russia. The purchase represents a substantial sum of money. It is expected that contracts for the supply of additional apparatus will be secured. While the company, in securing the business already obtained, has had to face competition from German manufacturers, British makers are finding Germans by no means the only, or possibly the most dangerous, competitors at the moment. This may possibly be due to the considerable orders that are understood to have been placed already in Germany. Swiss, Swedish, and Czecho-Slovak firms are eagerly competing for machinery and other contracts."

Dutch East Indies Trade.—The *Board of Trade Journal*, in a recent article upon trade in the Dutch East Indies, states that although 1922 was a bad year, the current year shows a great improvement. As regards rubber production, the Dutch growers refused to conform to restrictions, but the restriction of production on British-owned plantations has had an effect upon the market. Among the lines in which openings are said to exist are electrical fittings, and copper and brass sheet and wire.

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections to any of the proposed marks may be entered within one month from the dates mentioned. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Radocel. No. 437,565. Class 8. Primary or secondary electrical batteries not for medical use.—Edward A. Graham, trading as Alfred Graham & Co., St. Andrew's Works, Crofton Park Road, London, S.E.4. November 21st, 1923.

Simanco. No. 440,781. Class 8. Rheostats, electrical resistances and controlling switches for electric motors and for electric fans, and parts thereof.—The Singer Manufacturing Co., 149, Broadway, New York, U.S.A. (Cruikshank & Fairweather, 29, St. Vincent Street, Glasgow). November 21st, 1923.

Koobee. No. 440,178. Class 8. Component parts for wireless telephonic apparatus.—L. & I. Benson, 19, Irongate, Glasgow. November 21st, 1923.

Reppoc. No. 441,442. Class 13. Sparking plugs for internal-combustion engines.—Charles B. Hoare, 25, Edge Vale, Edge Hill, Liverpool. November 21st, 1923.

The F.B.I. and Fiscal Policy.—As reports have been current that the Federation of British Industries was not in favour of the Government's policy that is now being put before the electorate, it may be stated that the *Bulletin* of the Federation, dated November 20th, contains a summary of the proceedings of a meeting held on November 14th, from which a more correct view of the position may be obtained. Sir Eric Geddes reminded those present that the Federation, as an organisation, could take no action in regard to the fiscal proposals put forward by the Government. A draft letter had been circulated intended to be sent to the trade associations, advising them to lay their views before the Government without delay. He moved that the Director be instructed to dispatch this letter. After some discussion, Sir Eric said that the letter had been drafted before it was known that the election was so close. The Federation was continually submitting views to the Government on behalf of trade associations, and he did not think it would be advisable to depart from its usual practice merely on account of the election. The Government was working hard with a view to drawing up the lines of a tariff, and he thought it the Federation's duty to warn all its members to send forward their opinions as soon as possible. It must be made clear, both to the members and the Government, that any views forwarded through the Federation were the views of the trades concerned and not of the Federation as a body.

After further debate it was unanimously resolved that an amended letter, from which we make the following extracts, should be sent to the trade associations when approved by the president:—

"As you are aware, the opinions of different interests in the membership of the Federation vary widely as to whether any radical change in the fiscal policy of the country is desirable or not, and for this reason the Federation as a body can express no united opinion; nor at the present juncture would it be possible for them, as a non-political body, to take any part in a matter of such active political controversy.

"It is well known, however, that the Government are now preparing the tariff which will be put in force should they be successful at the forthcoming election. In these circumstances the Executive Committee feel that it is of importance to each trade to lay before the Government with the least possible delay a reasoned statement of their views upon the question, with the evidence and information—statistical and other—upon which these views are based.

". . . . Whatever views may be taken by your Association upon this controversial question, the services of the Federation and any information in its possession are entirely at your disposal, if they would in any way assist you in preparing any communication which you may wish to make to the Government."

Dramatic Entertainment.—To-night, Friday, at the Cripplegate Institute, Golden Lane, E.C.1, Henley's Dramatic Club will give a performance of "Beauty and the Barge."

New French Companies.—Under the style of the Etablissements Derogy has been constituted a company at Paris (31, Quai de l'Horloge) with a capital of 150,000 fr. in 500-fr. shares, of which 50 are allotted to Madame Derogy as consideration for assets. The capital may be raised to 1,000,000 fr. The scope of the company is the manufacture of optical and other instruments, and telegraphic, wireless and photographic apparatus.

Société d'Applications nouvelles de l'Electricité et de Mécanique is the name of a company established at Paris (39, Rue Corallotti), with a capital of 500,000 fr., to carry out novel applications of electricity and mechanics, including wireless telegraphy.

There has been formed at Paris (16, Rue des Martyrs) the Société d'Etudes et d'Aménagement de Forces Hydrauliques, with a capital of 100,000 fr., for the survey, harnessing and working of waterfalls, for which concessions are to be obtained. Power is secured to raise the capital to 2,000,000 fr.

The Société d'Electricité de Montfort et Extensions is the style of a company formed at Montfort l'Amaury (Seine-et-Oise) to supply current in the town named and neighbourhood. The capital is 150,000 fr. in 500-fr. shares. The promoter is the Compagnie Générale de Lumière et Traction, 2, Rue Jean Jauvrès, Puteaux, Seine.

China's Foreign Trade.—A review of the foreign trade of China during 1922 in a recent issue of the *Board of Trade Journal* shows that the total value of imported electrical materials (including telegraph and telephone) was 10,910,182 Haikwan taels, as compared with 14,845,120 taels in 1921. On the other hand, copper imports rose in value from 12,064,935 taels to 13,369,879 taels.

Valparaiso Port Works.—According to the *Review* of the London & River Plate Bank, the Government recently selected for acceptance the tender of S. Pearson & Son, Ltd., at $19,450,000 Chil. gold for the last part of the Valparaiso Port Works. No tenders were received for the construction of the port works at Constitucion, and the Government decided to carry out the works. The indifference of contractors is attributed to the condition imposed by the Government that the firm obtaining the contract would have to exploit the port for a number of years.

The Rating of Machinery.—The Minister of Health and the Secretary for Scotland have appointed a committee "to inquire into the present law and practice in regard to the rating of machinery and plant in England and Scotland respectively, to make recommendations as to the alterations which are desirable and practicable, having regard to the financial and other considerations involved, with a view to removing inequalities, and, if possible, assimilating the law and practice of the two countries; and to make definite proposals for giving effect to such recommendations." The secretary of the committee is Mr. G. R. Hill, of the Ministry of Health, Whitehall, S.W.1.

British Empire Exhibition Notes.—Birmingham's "Civic Week" at the Exhibition has been fixed to take place at the beginning of June, 1924. The object is to demonstrate the engineering (mechanical and electrical) and other industrial resources of the city, and to exhibit a wide range of her manufactured products. At a meeting of the recently-appointed committee, held on November 19th, under the presidency of the Lord Mayor of Birmingham, Mr. Charles Stanley, the manager of the British Industries Fair at Castle Bromwich, was appointed to act as organiser in co-operation with Mr. A. W. Smith, the secretary and manager of the Birmingham Gas Department. An executive committee was appointed, consisting of the following gentlemen:—Representing the Corporation: Mr. J. H. Broadley, secretary of the Water Department; Mr. J. Jackson, secretary of the Salvage Department; and Mr. E. J. Jennings, secretary of the Electric Supply Department. Representing the Birmingham University: Professor Burstall, Dean of Science and head of the Mechanical Engineering Department. Representing the manufacturers: Mr. Evan Davies, Mr. H. Atkinson, Mr. H. O. Worrall, Major Dibben (Federation of British Industries), and Mr. G. H. Wright (secretary of the Birmingham Chamber of Commerce). Mr. Gilbert Vyle, managing director of Messrs. Averys, Ltd., was invited to accept the chairmanship of the executive committee. He is the president of the Birmingham Chamber of Commerce.

The Exhibition authorities have issued a large attractive poster advertising the show. In the centre is a sepia drawing of a bridge over the Great Lake, and this is bordered by the coats-of-arms of the Dominions and dependencies, together with numerous symbolical devices.

The British Electrical & Allied Manufacturers' Association draws our attention to a scheme for the formation of excursion clubs for works and other organisations in connection with the Exhibition. The scheme goes so far as to give the prices of meals at the restaurants for such parties. Particulars of these excursion clubs can be obtained from the Controller of General Services, British Empire Exhibition Offices, 16, Grosvenor Gardens, S.W.1.

The Wembley Conference Programme.—Progress is being made with the programme of conferences to be held during the course of the exhibition at Wembley next year. Three conference halls are being built, and are well on the way towards completion. These can accommodate respectively 200, 600, and 1,800 people. The following bodies are among those which have definitely settled dates for their conferences:—

British Engineers' Association, April 30th.
British Engineers' Association, May 21st and 22nd.
Institute of Mining and Metallurgy, June 3rd to 6th.
Electrical Contractors' Association, June 18th.
World Power Conference. British Electrical and Allied Manufacturers' Association, June 30th to July 12th.
Thirty Club: International Advertising Convention, July 14th to 19th.
British Chemical Association, July 10th.
British Engineers' Association, September 17th.
Decimal Association, October 1st.
British Engineers' Association, October 15th and 16th.

Arrangements have been made between the British Science Guild and the National Joint Council of the Trade Union Congress and the Labour Party to hold a conference on science and labour on July 31st and August 1st and 2nd.

Fire Alarms.—Associated Fire Alarms, Ltd., has orders to install its system of automatic fire alarms throughout the new Tudor House of Messrs. Liberty & Co., Regent Street, and also the warehouse block in Little Marlborough Street.

The Westinghouse Company in Japan.—Negotiations have been completed between the Mitsubishi Takata concern and the Westinghouse Co. for the formation of the Mitsubishi Electric Co., with a capital of 15,000,000 yen, for the purpose of manufacturing Westinghouse machinery in Japan.—*Reuter's Trade Service* (Tokio).

Government Contract Conditions.—The lack of uniformity in Government contract conditions has long been a cause of complaint among manufacturers. One of the most serious points is the absence in many cases of any provision for the reference of disputed questions to arbitration. As the result of representations made by the Federation of British Industries, the War Office has now announced its willingness to adopt an arbitration clause in its contracts, except in cases of special stores of a nature not usually met with in commerce. As the War Office is one of the largest purchasing departments, this decision has given much satisfaction, and it is hoped other Government departments will follow the lead now given them.—*Times Trade Supplement.*

(*Continued on page 823.*)

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

The fifteenth annual report of the Commission was reviewed in our issue for November 9th (p. 690), and we reproduce herewith a number of illustrations embodied in the report, which were received too late to accompany our abstract.

Figs. 2 and 3 are a record of progress in the construction of the Queenston power house. The first of these is a view of the building and other works as they appeared from the United States side of Niagara River on December 20th, 1921, when the screen house in the upper part of the illustration was practically in skeleton form, the pipework only just commenced, and the power house half built. The second view shows the position less than a year after—on November 1st, 1922. In the meantime, however, three of the 45,000 - kVA sets had been placed in service, and shortly afterwards a fourth commenced running.

Fig. 1.—The Queenston Intake—Niagara River.

The immense size of the intake at the Niagara River for the Queenston-Chippawa development may be gauged from fig. 1, wherein two men can be seen (indistinctly) at the second diffuser opening. Between the third and fourth openings a wagon and two horses afford a further comparison. The mouth of each of these openings is 36 ft. wide and nearly 33 ft. high.

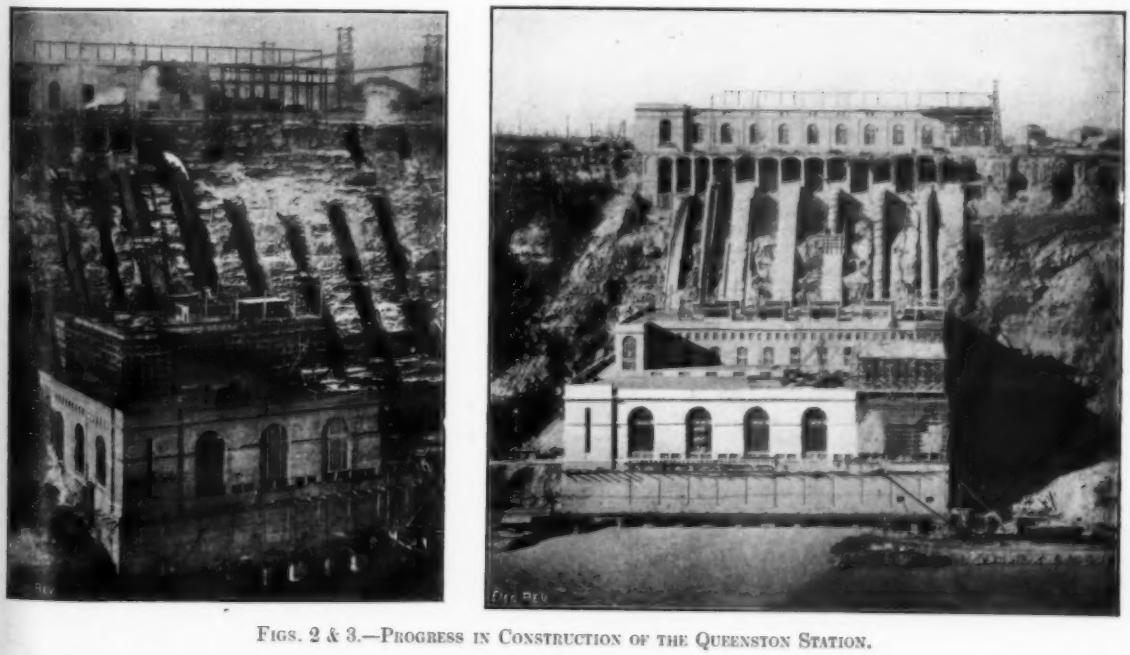
Some of the interior work at the Queenston power house is shown in fig. 4. This depicts the 110,000-volt bus connections and disconnecting switches employed in connection with the No. 3 set.

Fig. 5 is a view of the towers on the Queenston escarpment walls, which bear the 110,000-volt outgoing lines from the first three generators of the station.

During the year covered by the report the tie line from the Queenston generating station to the 110,000-volt trunk lines between Niagara Falls and Dundas was completed and put into operation. At the date of the report it was carrying more than 200,000 h.p.

The sub-station at Hamilton, illustrated in fig. 6, is an excellent example of its kind. This equipment has an initial capacity of 15,000 kVA in a bank of three transformers. Current is received from Queenston at 110,000 volts and stepped down to 13,200 volts for distribution to secondary sub-stations.

One of the most important recent developments is that at Ranney Falls in the Central Ontario and Trent System. The superstructure of this station measures 106 ft. by 85 ft., including the generator room, the switch rooms, control room, and gate-house. It is constructed of a structural steel frame with reinforced-concrete floor and roof slabs, with walls of concrete and



Figs. 2 & 3.—Progress in Construction of the Queenston Station.

The completed scheme provides for six of these openings in a breast wall parallel to the direction of flow of the Niagara River with retaining walls at each end. Between the main structure and the upstream shore, there is a ship channel, 80 ft. in width, providing for the installation of a single pair of lock gates. The whole structure, including the inner basin, occupies an area of about 20 acres.

stone masonry. The installation (see fig. 7) consists of two vertical-shaft sets mounted on 40-ft. centres. They were built and installed by the Canadian General Electric Co. The machines are normally rated at 4,500 kVA, 3-phase, 60-cycle, 6,600-V, 120 r.p.m., at 80 per cent. power factor, with 40 deg. C. ambient air temperature. They are capable of carrying 5,300 kVA at 80 per cent. power factor continuously, with cool-

ing air at an ambient temperature of 15 deg. C. The overall diameter of the stator is 20 ft. 9 in. and that of the rotor over the pole faces 17 ft. 9½ in. The stator frame is 3 ft. 8 in. high, and the overall height of the machine above the main floor level to the top of the exciter is 14 ft. The shaft extends 5 ft. below the floor level, where it is bolted through a flanged coupling to the turbine shaft. The rotor is so designed that no fan blades are required to force cooling air (30,000 cu. ft. per minute) through the stator laminations and windings. The rotor is of cast steel in one piece, and has a rim suitable for the application of brake shoes. The stator frame is of cast iron in two sections, and the upper bearing bracket is also made in two sections, but of cast steel. The armature coils have mica tape insulation. The thrust bearing supplied with each generator is of the standard General Electric spring type. It is capable of carrying a load of 190,000 lb., which takes care of the weight of the rotor and the total thrust due to the turbine. Special fire-fighting apparatus has been provided with each machine, consisting of pipe rings arranged round the top and bottom end connections of the stator windings, provided with small

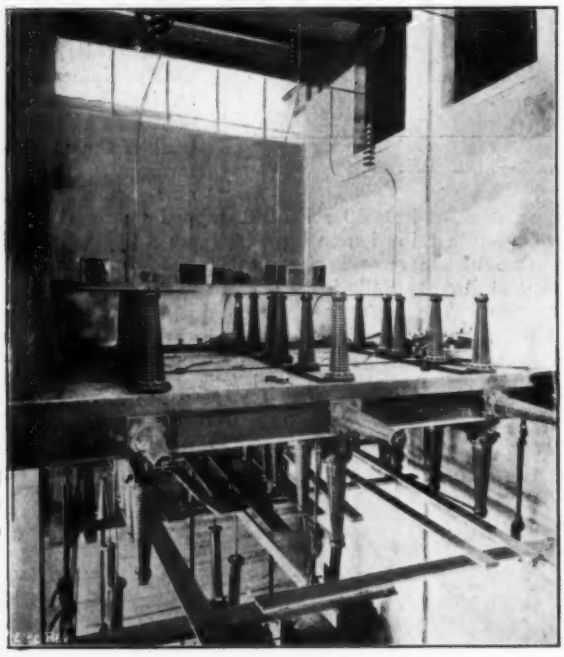


Fig. 4.—Switchgear of Queenston No. 3 Set.

nozzles at every 15 in. These nozzles are set at an angle such that when they come into action the end connections are covered with a spray of water. The water in the pipes is controlled from the switch-room; the operator has first to make a flexible hose connection and then turn on the valve. The sets are also equipped with air brakes supported on the lower bracket arm. Controls for these are in duplicate, one placed beside the governors on the main floor and the other in the switchboard-room. An electric alarm gives warning in the event of the air pressure falling. The generators are star-connected. The neutral and main leads are carried through fibre conduit to a point approximately 15 ft. from the generator, where the main leads are connected to busbars and the neutral leads are run through current transformers and connected to bars. Two parallel, varnished-cambric, lead-covered cables carry the power from this point to the bus in the switch structure. There is a disconnecting switch placed at this point, so that

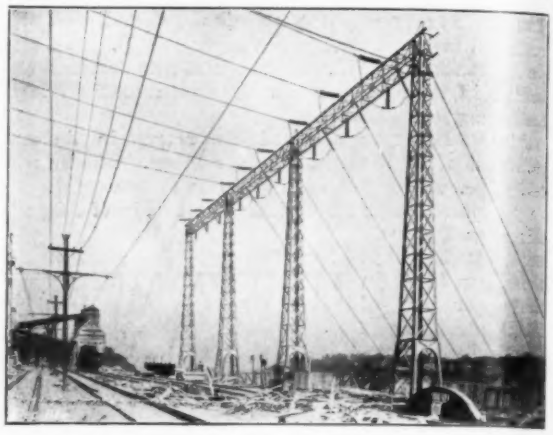


Fig. 5.—Queenston Transmission Line Terminal.

the neutral of either machine may be "dead grounded" to the station ground bus. Differential protection has been provided, consisting of three single-pole .5 to 1.5-A relays (inductance type), which, in case of trouble in the generator or its main cables, will open the generator main breaker, or the emergency-bus feeder switch if it is being used as a generator breaker, and both the field switches. Each generator is equipped with a 50-kW, 125-V, shunt-wound, direct-connected exciter, the armature being carried on a short shaft which is bolted to the top of the generator shaft. There is also a spare 50-kW set. The output from the generators is stepped up for transmission to 44,000 V by two 3-phase, 4,500-kVA, core-type, water-cooled transformers. These are connected in delta on the low-pressure side and in star on the high-pressure side. Taps are provided so that voltages of 42,000, 46,000, and 48,000 may be obtained, and the neutral of the high-voltage winding is brought out through the cover. They are equipped with oil expansion tanks, which are mounted on the main tank. Elaborate lightning-arrester equipment is provided with the switchgear on the 44,000-volt side, shown in fig. 8.

The low-voltage circuit breakers have a rupturing capacity of 325,000 kVA, and those on the high-pressure side of 225,000 kVA. Provision has been made for two outgoing high-pressure circuits, but only one had been connected up at the date of the report. The time relay protection consists of three single-pole, unidirectional

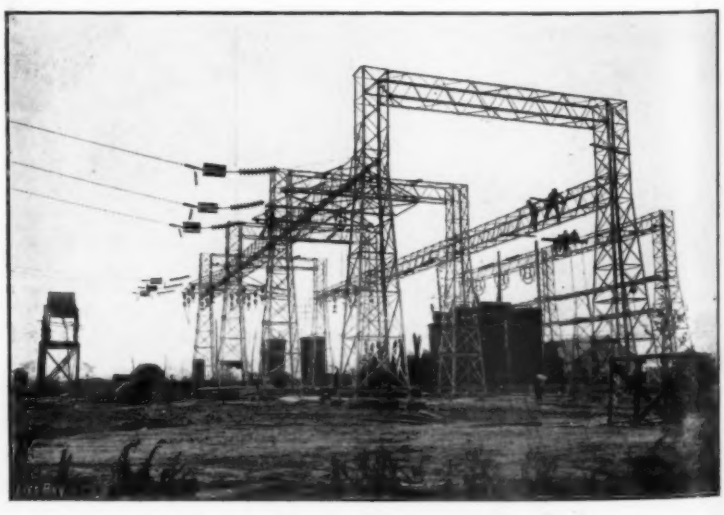


Fig. 6.—The Hamilton Transformer Station.

relays, which function when excess power flows out from the station, and one earth relay which has its tripping

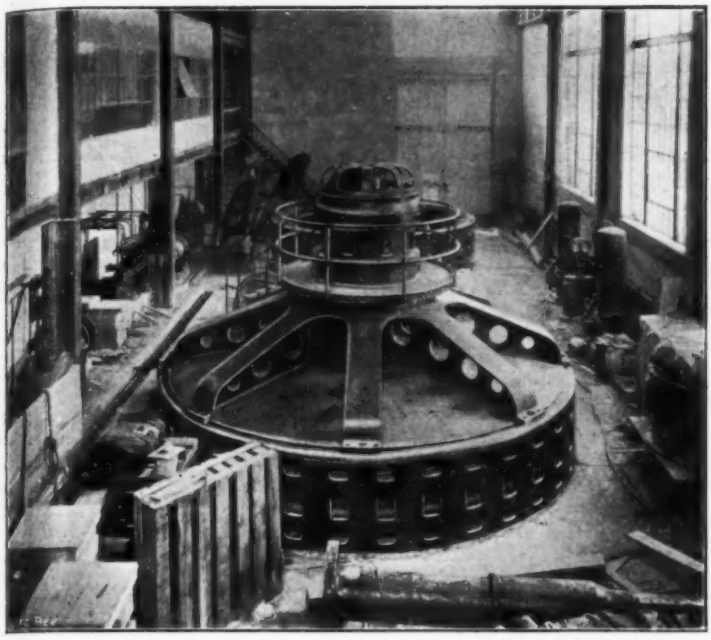


Fig. 7.—Ranney Falls Power House.

prevented the entire power house from being flooded, and showed conclusively that a valve of modern design could be closed safely and quickly with practically free discharge through a penstock 10 ft. 6 in. in diameter. The generator that failed was not tested to runaway speed when first installed (in 1919), due to load conditions which made such a test inadvisable. Had this test been made, the machine would, no doubt, have gone to pieces with disastrous results, as at that time it would have been impossible to have obtained sufficient power to meet the loss of output from the damaged machines. The loss of generating capacity did not seriously affect consumers. The accident occurred early in the morning, and five hours later consumers were being supplied from another part of the Commission's system.

The final picture (fig. 10, p. 822) is a sketch of a projected scheme for utilising the main thoroughfares of a city as a route for transmission lines. The study of the transmission line network in the vicinity of Niagara Falls and Queenston has brought out very clearly the necessity for some co-ordinated scheme for such lines as they become more numerous in the various districts. Two or three municipalities have approved of the erection of steel structures along the boulevard or planted strip in the centre of a right of way 66 ft. or more in width. The illustration shows an example of such an arrangement, in which the tramway track runs beneath large towers supported on piers, the piers themselves being also used for the support of tramway loading platform roofs. A spacing of from 500 to 700 feet is suggested for the towers.

contacts connected in series with the wattmeter elements on the unidirectional relays to provide selective action.

The next illustration (fig. 9) indicates the result of a heavy short circuit in a generator in the station which formerly belonged to the Ontario Power Co. This caused the water-wheel to run away, and the excessive speed burst the generator rotor, which destroyed the whole set and injured other machines in the station. The accident was stated to be due to defective castings in the rim of the generator rotor.

The bursting of the machine caused the collapse of the roof trusses, bringing down the heavy concrete roof, which knocked a large piece from the turbine casing, allowing water to be discharged into the power house for about four minutes. The prompt closing of the main penstock valve on the damaged turbine

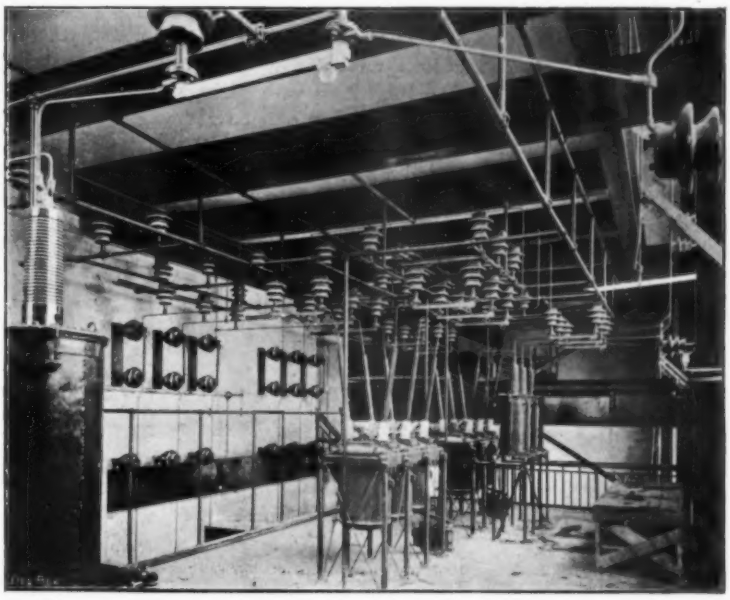


Fig. 8.—44,000-V Switchgear at Ranney Falls.

Fig. 9.—Damage Caused by Burst Generator

A VISIT TO ASSOCIATION ISLAND.

By L. G. HAWKINS.

THE title of this reflection means but little to the British reader, but to our electrical cousins in the U.S.A. it stands for development, good fellowship, an ideal break from city life, hard work, and hard play.

Association Island is the property of some of the broadest-minded men in the electrical world who realise many of the fundamental factors in life and know that ideal work can only originate in ideal surroundings. The exact situation of the island is at the extreme eastern end of Lake Ontario. Its total area is about 60 acres. The nearest railroad is at a distance of 15 miles. It is an all-night run from New York, an all-night run from Chicago, and a five-day run from California, yet so important do those interested in electrical trade development consider it that they flock from all parts of the country, irrespective of distance, to take part in the live discussions which decide what line of progress shall be adopted.

The island is a most picturesque spot miles away from all town life, beautifully wooded, and has a good golf course, tennis courts, putting and bowling greens, splendid fishing, bathing, and boating. The sleeping accommodation consists of commodious rectangular canvas tents, each equipped with two double beds with spring mattresses, wardrobes, electric light, and an outside sun awning under which deck chairs are most welcome after the day's work. Adequate and up-to-date sanitary arrangements, shower baths, hot and cold water, &c., all add to the comforts of the wonderful camp. The best of food is supplied in the sunny dining hall overlooking the lake and wonderful scenery. Cheery music is provided to assist digestion, while the camp store, which is located in the Administration Building, supplies everything from chewing gum to the hip-pocket flask, which is such a necessity of life in countries where prohibition exists!

The laws of the island are clearly defined in a neat booklet. For instance, nobody is allowed to wear collar or tie, the idea being to allow for the maximum of comfort. Upon those who unknowingly or otherwise disregard such laws, penalties are imposed, a favourite one being compulsory immersion in the lake, irrespective of who the person is, whether a principal shareholder or an electrical contractor.

Electrical dealers and contractors, wholesalers, central station men, and manufacturers all get together and openly discuss all points as they arise. Competitors decide on policies and apparently stand by decisions made, realising that co-operation amongst competitors results in profitable business and eliminates to a very large extent price cutting, business failures, and unprofitable transactions.

Conferees at certain camps are allowed to bring their wives, and a very noticeable feature indeed is the keen interest they take in their husbands' electrical affairs, for the wives are much more of a factor in their husbands' business than is at least noticeable in the British Isles.

Possibly from what has been written, you will mistake this serious business camp for purely a pleasure resort disguised under the name of business. This is not so. Never have I attended more earnest business meetings, and a very noticeable fact was that everybody aired his views in a thoroughly straightforward manner. The meetings were not governed by the chairman and a few professional speakers. In the true meaning of the phrase they were "general meetings" for the settling of definite electrical trade policies.

After a few days' visit to the island it is very easy to realise why America is so far ahead of us electrically. It is not, as generally supposed, that the electricity rates are cheaper. Such is not the case.

The true reasons are that the trade as a whole has been organised efficiently, financed efficiently, advertised efficiently, and the word "co-operation" has a real meaning. Manufacturers making similar goods co-operate. Dealers in the same localities co-operate. Central stations co-operate, and throughout the year this system continues.

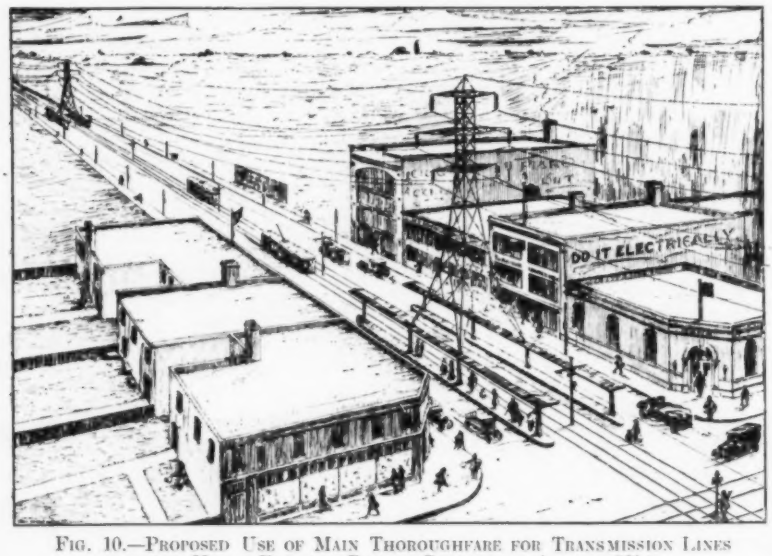


FIG. 10.—PROPOSED USE OF MAIN THOROUGHFARE FOR TRANSMISSION LINES OF THE HYDRO-ELECTRIC POWER COMMISSION (see p. 821.)

The manufacturer who organises a campaign of any kind has the very solid backing of the central station, the wholesaler, and the retailer, and is thus able to make his advertising pay and produce electrical goods in such quantities that the business is worth while. This co-operative spirit keeps prices at such a point that the best-quality products can be produced and sales are made on quality rather than on price. How pleasant it would be to have similar electrical trade conditions existing in our own country. How the salesmen would appreciate that hand of co-operation in place of the stock phrase: "They won't sell in this district." How splendid it would be to have all of our central station men working with us instead of only a few, and proving that the electrical way is the best way—willing at least to test every piece of new apparatus, trying the effect of all new lighting units, &c.

If the electrical business is ever to be worth while in the British Isles, we must do something to assure progress. We must get together and make things good rather than blame international conditions.

It can be done, and it must be done. The other fellow has done it in a few years—why can't we?

(Readers interested can obtain details of what they are doing in the U.S.A. from Mr. William L. Goodwin. The Society for Electrical Development, Incorporated, 522, Fifth Avenue, New York.)

BUSINESS NOTES.

(*Continued from page* 818.)

The Question of Direct Trading.—At a meeting of the Council of the Birmingham Chamber of Commerce, on Monday, the Retail Section reported that the Corporation Electric Supply Department had opened a new showroom for the sale of electrical appliances, and correspondence had taken place on the subject of direct trading. The department stated that as a result of negotiations with the Electrical Contractors' Association, a friendly arrangement had been made by which contractors and retailers introducing a customer should have a certain percentage of profit reserved, and that under no circumstances would the department undertake either wiring or installation work, nor the sale of lamps except in cases of emergency. The bulk of the discount on fittings sold to consumers passed to the retailers. The section thought this left the position still unsatisfactory, its view being that the Corporation's activities should be directed solely to an increased consumption of current, and that it should not enter into direct trading with the public by competition with the local traders. In moving the adoption of the report, Mr. Adams said that retailers were anxious that they should not have established there a department similar to that of the gas undertaking. They thought the Corporation should be satisfied with encouraging the consumption of current. The matter was referred to the General Purposes Committee for further consideration.

A Business Opportunity.—Information has been received in the Department of Overseas Trade to the effect that an electric power commission overseas is considering important extensions to its plant. This comprises several steam-electric plants of the largest type and a low-temperature plant for the carbonisation of coal. The commission would be interested to receive any information that would be of assistance to it in connection with the equipment and operation of such plant. It is particularly stated that the commission is not interested in small plant. Firms supplying British material who wish to follow the matter up are invited to apply to the D.O.T., 35, Old Queen Street, S.W.1, quoting the reference D.O.T./12,580/E.D./E.C.(2).

Electrical Companies in Czecho-Slovakia.—An extraordinary general meeting was called recently to sanction the amalgamation of the Nordböhmische Elektricitätswerke company with that of Siemens Elektrische Betriebe of Turn-Teplitz, and to raise the capital from 6,000,000 to 10,000,000 kronen by the issue of 10,000 400-kr. shares.

The Elektro-Apparate Fabrik company, of Warnsdorf, has decided to raise its capital from 2,500,000 to 4,500,000 kronen.

A general meeting of the Osram company, of Prague, decided to allot from the net profits of the year 1922-23 of 1,075,760 kronen, the sum of 1,067,294 kronen to sinking fund for buildings and machinery, carrying the balance of 8,466 kronen to the next year's account. The business outlook for the New Year is stated to be good. The company has acquired a glass factory to meet its own requirements.

The Bohemian firm of Breitfeld, Danek & Co., of Schlau, is stated to have orders in hand of the value of 100 million crowns.

Orders for 170 locomotives, to be delivered in 14 months for the Czecho-Slovak railways, have been placed locally with the Kolben company, of Prague; the Skodawerke, of Pilsen; and Breitfeld, Danek & Co., of Schlau.

The Japanese Earthquake and Reconstruction.—A Reuter dispatch, mailed from Osaka under date October 4th, says that the destruction of insured property alone is officially put at 2,200,000,000 yen, and this does not include Government-owned property, such as telegraphs, telephones, railways, arsenals, and other army and navy property, none of which is insured against fire or earthquake. A total figure of 3,000,000,000 yen is not altogether imaginary. Now that the general preliminary arrangements and regulations for the reconstruction of the capital are completed, orders for various kinds of machinery and material are being placed with the factories of this district, while considerable orders have been or will shortly be placed abroad. This is resulting, in this part of the country at least, in an increased pressure on the factories concerned, and it is reported that several are preparing to engage extra hands. Among the orders reported to have been already sent to Osaka are those for electrical machinery for the Tokio electrical bureau, one for a number of street cars to replace those that were burnt up or otherwise damaged on the streets of the capital, and others for telegraph and telephone wires, railway sleepers and carriages, and different kinds of building materials.

The idea of removing the Tokyo Imperial University to a more suitable locality seems to find increasing favour among the professors and the students, in view of the fact that as the result of a recent conference the Students' Association has appointed a general committee to examine the question of removal.

For Sale.—Burnley Corporation Electricity Department invites offers for one 250-kW Belliss-Dick, Kerr generating set with condensing plant; Heckmondwike Urban District Council Electricity Department has for disposal surplus plant comprising generating sets, condenser, booster, feed pumps, &c. (See our advertisement pages to-day.)

LIGHTING AND POWER NOTES.

Adwick-le-Street. — Electricity Agreement. — The Urban Council has entered into an agreement with the colliery company for a supply of electricity for power at 1½d. per kWh. The colliery company has undertaken to wire all the houses in the district elonging to it.

Australia.—Brisbane.—The Queensland Government is considering the formation of a trust to control the generation and distribution of electricity in Brisbane. The proposal concerns two companies—the City Electric Light Co. and the Ipswich Electric Supply Co.—and the municipalities in the suburbs of the city. These municipalities have combined to form a Metropolitan Electricity Board which takes a bulk supply from the City Electric Light Co. for distribution. The Ipswich company also distributes a bulk supply from the City company. The Government's scheme is welcomed by the Board, but the attitude of the company is uncertain.

Ithaca (Queensland).—The Town Council is to raise a loan of £75,000 for the purpose of acquiring the whole of the Brisbane Tramway Trust's electric plant, and completing the reticulation of the town for electric light.

Bath.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £9,875 for mains and services.

Boston.—Proposed New Power Station.—The Boston and District Electricity Supply Co., Ltd., has applied to the Electricity Commissioners for permission to establish a generating station near the docks.

Buckhurst Hill.—Electricity Order.—The Urban District Council has decided to consent to the application of the County of London Electricity Supply Co., Ltd., for an Order to supply electricity in the town.

Canada.—Queenston.—The fifth of the Queenston generators was put into commission a few weeks ago, and it is expected that the sixth will be available before the close of the year. The new 110,000-V line from Queenston to Allanburg was put into operation recently. This gives a second double-circuit line from the Queenston plant to tie in with the Niagara system.

Continental.—Sweden.—The Swedish Waterfalls Administration estimates that the working expenses of the department will amount to 9,000,000 kr. in the calendar year 1924, this sum comparing with 8,760,000 kr. in 1923. The surplus of income over expenditure of the State power stations is computed at 9,580,000 kr. for next year, of which the Trollehatte works is put at 3,930,000 kr., the Alvkarleby works at 4,390,000 kr., and the Motala works at 1,015,000 kr.

France.—The schemes now in hand for the harnessing of the Dordogne River and the greater and lesser Rhue Rivers will involve the building of the highest dam in the world, that on the middle of the Dordogne. It will be 375 ft. high, and situated at Chambon. Three other dams will be built on the same river, two in the Argentan neighbourhood and one at Brivezae. The undertakings form part of the concession granted to the Compagnie d'Orléans for the electrification of its railway network.

Turkey.—According to the report recently issued for 1922 by the Société Ottomane d'Electricité, of Constantinople, notwithstanding an increase in the output of the generating plant from 29,100,500 kWh in 1921 to 31,598,340 kWh last year, there was a slight reduction in the receipts owing to the reduced charges and to a falling off in the demand for electricity for power. The number of consumers increased from 21,656 to 27,593. During the year a 10,000-kW turbo-alternator set was added to the generating plant, while a further set of similar capacity is at present in course of installation.

Czecho-Slovakia.—The Administrative Board of the Prague electrical enterprises has decided to reduce the price of electricity for lighting purposes by 10 per cent. to 3.60 kr. per kWh. For power the reduction amounts to 11 per cent. The new prices come into force on January 1st.—*Reuter's Trade Service* (Prague).

Latvia.—It is reported that the Latvian Government has received offers from a group of Swiss capitalists to erect a power station at Dahlen. The group states that it is prepared to invest 11 million Swiss francs in the proposed scheme.

Italy.—According to a report published by the Ministry of Public Works, the total capacity of all generating stations is 1,582,528 kW, of which 1,239,093 kW represents hydro-electric plant. The *per capita* consumption during 1921-22 was 85 kWh, or 15½ kWh more than the average consumption for Europe.

Denmark.—The Municipal Council of Gudenaa is negotiating with the German Siemens Co. with regard to the use of peat fuel for generating electricity. According to a Danish expert on fuels, there is sufficient peat to provide all the fuel required to meet the country's demand for electricity.

Fleetwood.—Proposed Power Station.—The Urban District Council has passed a resolution expressing disapproval of the proposal of the Lancashire Electric Power Co. to erect a power station near to Padiham, but it is prepared to support an application for the erection of such a station at Burnley by the Corporation of Burnley.

Hoddesdon and Broxbourne.—ELECTRICITY CHARGES.—The North Metropolitan Electric Supply Co. has applied to the Ministry of Transport for permission to charge a flat rate of 8d., or 10d. per kWh for the equivalent of the first 100 hours' use per quarter of the maximum demand, and 4d. per kWh beyond, with minimum payments of 10s. for the winter quarters and 6s. 8d. for the summer quarters.

Irish Free State.—DUBLIN.—At a recent meeting of the Dublin Port and Docks Board, the engineer reported that the generating station would shortly be closed down, and thereafter the supply required would be taken from the Corporation power station.

Keighley.—NEW PLANT.—The Electricity Committee has recommended the borrowing of £50,000 for the installation of a 5,000-kW set, with boilers and equipment. The borough electrical engineer (Mr. H. Webber), reporting on the proposed new plant, said that before deciding to recommend the installation of the additional 5,000-kW set, the Committee approached Bradford Corporation to see if that authority could do anything for Keighley's needs. The Commissioners also consulted with Bradford, but the reply showed that Keighley would be isolated for at least three years, as Bradford would require all the electrical energy it generated. The Committee reports receipt of the Electricity Commissioners' sanction to the borrowing of £2,630 for motors to be let out on hire.

Lancaster.—ELECTRICITY EXTENSIONS.—The Town Council proposes to put in hand the duplication of the existing main from the River Lune sub-station at Marton Street at a cost of £2,900, and to improve the distribution system at a cost of £14,500 by establishing sub-stations in Ashton, Scotforth, and Bowerham, and laying a network of l.p. cables to give an alternating-current supply.

Liverpool. — BREAKDOWN. — On November 21st a fault occurred in the mains system, causing the circuit breakers affecting the central area of the city to open at the main station in Fairclough Lane. The tramcar service was held up for three-quarters of an hour. Due to fusing in a transformer and switchgear, there was an outbreak of fire, which fortunately was speedily extinguished. In less than an hour the generating plant was again carrying the full load.

London.—KENSINGTON.—As a result of representations by the Council, the Brompton and Kensington Electric Supply Co. has reduced the electricity charges to the Council from 4d. to 3½d. per kWh.

ST. PANCRAS.—*Pulverised Fuel.*—The Electricity and Public Lighting Committee recommends that the chief electrical engineer and the chairman of the Committee be authorised to visit and inspect undertakings in which pulverised fuel is being employed, with a view to the adoption of this method of boiler-firing in the Council's station. Boilers which are now ready for delivery are being held up pending a decision on this question.

ST. MARYLEBONE.—The Works Committee recommends the substitution of gasfilled 100- and 150-W lamps for the vacuum type now employed in thirteen main thoroughfares.

New Zealand.—DUNEDIN.—The accounts of the City Council's electricity undertaking (engineer: Mr. M. C. Henderson) for the year ended March 31st last show a total revenue of £115,748, as compared with £101,651 in 1921-22. Working expenses absorbed £37,397, as against £36,192, leaving a gross profit of £78,368 (£65,458). After deducting interest, &c., there was a net surplus of £27,288, as compared with a surplus of £21,423 in the previous year. A total of 20,092,361 kWh was sold, and connections were increased by 1,897 to 24,737.

LAKE COLERIDGE.—The report of the Lake Coleridge hydro-electric undertaking for the year ended March 31st last shows a total income of £69,153, as compared with £56,814 in the previous year. Working expenses amounted to £19,271, as against £25,911, leaving a gross profit of £49,882 (£30,903). After deducting interest, depreciation, &c., there was a net surplus of £5,300, as against a profit of £1,498 in the previous year. The amount of electrical energy sold increased by 4,617,693 to 37,561,627 kWh, and the total connected load increased to 49,343 kW.

WAIKATO (HORAHORA).—The accounts of the Horahora undertaking for the year ended March 31st last show a total revenue of £41,818, as compared with £28,207 in 1921-22. Working costs amounted to £9,721 (£7,986), leaving a gross surplus of £32,097 (£20,221). Interest and depreciation absorbed £25,828, leaving a net profit of £6,269, as against a surplus of £2,522 in the previous year. 30,030,369 kWh of electrical energy was was sold, an increase of 6,936,774 kWh. The undertaking is to be linked up with the Arapuni scheme, which will supply electricity to Auckland, and the electrical energy generated at Horahora will be used at Arapuni during construction.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

BIRKENHEAD.—Electricity supply within the borough. Lighting: A general reduction of ¼d. per kWh. Heating and cooking: A reduction of ¼d. per kWh. Power: A reduction of ¼d. per kWh up to 1,500 kWh and ½d. beyond. Similar reductions have been made in districts outside the borough, with the exception of the charges for heating and cooking, which have been reduced by ½d. per kWh.

HAMMERSMITH.—Lighting: 5d. to 3d. per kWh, according to amount consumed. Power and showroom supplies: First 30,000 kWh per annum, 1.5d. per kWh; above this amount, 1.4d. per kWh. Combined lighting and power: Tariff "A," first 30,000 kWh per annum, 1.5d. per kWh. Tariff "B": From 1.17d. per kWh for the first 1,000,000 kWh to .97d. per kWh for 3,000,000 kWh. Tariff "C": To consumers using over 3,000,000 kWh per annum, from 1d. to .8d., according to quantity consumed.

Rhayader.—NEW POWER STATION.—The Rhayader Electric Light and Power Co., Ltd., has applied to the Electricity Commissioners for permission to establish a generating station in the town.

Rugby.—ELECTRICITY AGREEMENT.—The Urban District Council has consented to the application of the Leicestershire and Warwickshire Electric Power Co. for permission to supply electricity to the British Thomson-Houston Co., Ltd. Under an agreement any consumer in the Council's area who requires a load of 500 kW or over can take it direct from the Power Co.

Ruskington.—PROPOSED ELECTRICITY SCHEME.—The Urban District Council, in view of the fact that plant at the waterworks will soon need renewing, has requested the Water Committee to consider the advisability of installing plant for combining pumping and electricity supply. It is proposed to erect overhead lines to supply the town.

St. Neots.—PROPOSED ELECTRICITY SUPPLY.—A meeting of residents was recently held to discuss the formation of a company to supply electricity in the district. A scheme was submitted by Messrs. Christy Bros. & Co., and it was decided that the company should take steps to ascertain whether the necessary capital could be raised. The estimated capital cost of the scheme is £12,000. A public meeting is to be held at a later date.

West Riding (Aire and Calder) Electricity District.—LOCAL INQUIRY POSTPONED.—The Electricity Commissioners inform us that in view of the forthcoming General Election and representations made to them, they have decided to postpone the local inquiry at Bradford, which was fixed for December 4th.

York.—BREAKDOWN.—The lighting supply in a part of the city recently failed. The failure was reported to be due to a breakdown in the main trunk feeder from the Foss Island generating station to the centre of the city. The tramway service, being on another feeder service, was not interrupted.

TRAMWAY AND RAILWAY NOTES.

Continental.—SWITZERLAND.—The Centovalli electric railway from Locarno, in Switzerland, to Domodossola, in Italy, was officially opened on November 25th by the Swiss and Italian authorities. The line is 25 miles long, and connects the Simplon and St. Gotthard routes, and shortens by nearly four hours the journey from Geneva and Berne to the Canton of Ticino and the Lakes of Lugano and Como.—*The Times.*

London.—L.C.C. TRAMWAY PLANT.—The Highways Committee of the London County Council has received tenders for the installation of a 15,000-kW turbo-generator, condensing plant, and accessories at the Greenwich power station, and asks for approval of the expenditure of £86,000 on this account.

New Zealand.—DUNEDIN.—The report of the tramway manager (Mr. W. H. Mackenzie) on the working of the tramway undertaking for the year ended March 31st last shows a total revenue of £129,910. Working expenses amounted to £81,965, leaving a gross profit of £47,945. After meeting capital charges, &c., there was a net profit of £8,706. The previous year's working resulted in a profit of £4,555. The number of passengers carried was 19,245,172, and the number of car-miles run 1,515,125.

North Lancashire.—LIGHT RAILWAY.—At a conference of representatives of several local authorities in North Lancashire it was recommended that each authority should subscribe £1,000 per mile towards the cost of laying the Hellifield to Longridge railway.

Plymouth.—TRACK REPAIR.—The Tramway Committee has instructed the engineer to submit a plan and report on the condition of the track throughout the whole tramway system, and an estimate of the cost of the repairs necessary to put the track in proper condition.

TELEGRAPH & TELEPHONE NOTES.

France.—TRANSATLANTIC CABLE.—The new transatlantic telegraph cable between the U.S.A. and France has been landed at Havre.

India.—RADIO TELEPHONY.—Greater appreciation of the value of radio-telephony is apparent in India, especially among the more enterprising native States. The latest installations reported are at Srinagar and Jammu City in Kashmir, which

are separated by mountains 15,000 ft. high. The success of radio-telephony in this instance has led other States to consider similar projects, stations being under contemplation in Bhopal, Gwalior, Hyderabad (Deccan) and Rajkot.—*Commerce Reports.*

Italy.—Telephone Concession.—According to reports from Stockholm, representatives of the L. M. Ericsson Co. are in Italy for the purpose of negotiating with the authorities in the matter of obtaining concessions of the telephone system in that country. The proposals of the Italian Government are said to be the division of the country into districts which are to be given to concessionnaires. Keen competition is expected to be met by the Swedish company, particularly from the Germans.

Russia.—New Petrograd Radio Station.—According to the *Ost Express*, a new radio station has been opened at Tsarskoye-Selo, near Petrograd.—*Reuter's Trade Service* (Petrograd).

Siam.—Radio Telephony.—Demonstrations in Siam with Marconi duplex wireless telephone sets by a representative from England have interested officials. The Italian agents of the Marconi Co., Messrs. G. Kluzer & Co., have a few sets on order. The maximum range guaranteed is 75 miles. It is not expected that broadcasting will ever become a recognised thing in Siam, but the radio telephone may develop a limited use commercially if continually encouraged by representatives on the spot, says *Commerce Reports.*

RADIO NOTES.

Belgium.—Broadcasting.—The first radio telephone broadcasting station was opened on November 25th at Brussels.—*Daily Mail.*

Radio-Broadcasting.—Transatlantic Tests.—It is reported in the daily Press that broadcast radio-telephony across the Atlantic was accomplished by the British Broadcasting Co., Ltd., in the early hours of November 26th, when some of the English stations were heard in various parts of America. During the early hours of November 27th American stations reciprocated and several of them were heard at different places in this country, but "atmospherics were terrific," and oscillating sets also caused some trouble. Apart from the B.B.C. transmission, the Radio Society of Great Britain is organising an amateur test on December 22nd between 1 and 3 a.m., and French amateurs will try on the following night. An endeavour will be made to transmit messages in Morse code across the Atlantic, and the G.P.O. is permitting a number of amateur stations to increase their normal power of 10 watts to 1 kW for the tests. On January 11th the American Relay League will transmit to this country.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Australia.—Sydney.—February 6th. New South Wales Government Railways and Tramways. Equipment of two sub-stations.*

February 27th. Motor generator sets, batteries for switch operating, motor air compressors.*

February 18th. Municipal Council. Armour-clad switchgear.*

February 11th. Sydney Harbour Trust. Two double-drum horizontal electric capstans.*

Melbourne.—January 9th. Government Railways. Spring coiling machine, with electric motor; taper rolling machine, with electric motor.*

January 9th. Two small induction motors, with starting apparatus.

Belfast.—December 1st. Tramways Committee. Construction of about 3,200 yd. of single track. (November 23rd.)

Belgium.—December 19th. La Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Underground electric cables required in connection with the lines in the Northern Antwerp section.

December 5th. Municipal authorities of Petit-Spauwen (Province of Limbourg). Establishment of a low-pressure electricity supply system in the town.

December 5th. Municipal authorities of Francorchamps (Province of Liége). Establishment of an electricity supply system in the town.

December 10th. Municipal authorities of Schaerbeek, Brussels. 1,700 electricity meters.

Bramley (Leeds).—December 12th. Board of Guardians. Electric lighting installation at the Institution. Mr. A. Gaunt, Clerk to Bramley Union, Board Offices, 1, Green Hill Road, Armley, Leeds.

Dublin.—December 11th. Dublin Port and Docks Board. Electrical supplies for 12 months. Mr. E. H. Bailey, secretary to the Board, Westmoreland Street, Dublin.

Edinburgh.—December 4th. Tramways Department. Tramway cars, trucks, and electrical equipment. Tramways manager, 2, St. James' Square, Edinburgh.

December 10th. Electricity Supply Department. Pavement box frames and covers, house service fuse boxes, underground conduits for electricity supply cables. (November 23rd.)

Glasgow.—January 16th. Cleansing Department. Tenders and designs for refuse disposal works at Govan. (November 16th.)

Greenock. — December 8th. Electricity Department. Three 3,000-kVA transformers, h.p. switchgear, transformers with boosters, and induction regulators. (November 16th.)

Ilford.—December 10th. Electricity Department. E.h.p. and l.p. cables, joint boxes. (See this issue.)

India.—Delhi.—January 21st. Public Works Department. Turbo-alternator set, condensing plant, cranes, boiler-house plant, economiser, steel chimney, pipework, switchboards, converters, sub-station plant, e.h.p. feeder cables and accessories. Specification, &c., from the Chief Controller of Stores (Engineering Section), Indian Stores Department, Delhi.

Bombay.—December 17th. One motor-driven air compressor. Deputy Executive Engineer, Mechanical Branch, Municipal Workshops, Foras Road, Bombay.

Keighley. — December 17th. Electricity Committee. 5,000-kW turbo-generator and condensing plant. (See this issue.)

Leeds.—December 10th. Electricity Committee. Coal for the Electricity Department during the half-year ending June 30th, 1924, or, alternatively, during the year ending December 31st, 1924. Mr. C. Nelson Hefford, manager, Electricity Department, 1, Whitehall Road, Leeds.

London.—St. Pancras.—December 6th. Electricity Department. One vertical electric motor-driven condensing-water pump, capacity 750,000 gallons per hour. (November 16th.)

Metropolitan Asylums Board.—December 5th. Alterations and extensions to the electric lighting and power installation in the new kitchen at Tooting Bec Mental Hospital. (November 23rd.)

London County Council.—December 31st. One three-ton three motor-type overhead travelling crane, one 30-hundredweight motor-driven portable workshop crane for the L.C.C. tramway repair depôt. General manager, L.C.C. Tramways, Victoria Embankment.

Maidenhead.—December 4th. Board of Guardians. Electric lighting installation, infirmary block and St. Mark's Church. Mr. T. W. Stuchbery, clerk, Tyne Improvement Com-

Newcastle-on-Tyne.—December 1st. Tyne Improvement Commissioners. Thirteen sets d.c. electric motors and accessories. Mr. A. Blacklock, secretary, Tyne Improvement Commission, Newcastle-on-Tyne.

New Zealand.—Wellington.—January 30th. Post and Telegraph Department. 30,000 galvanised-iron earth rods.*

Plymouth.—December 20th. Electricity Department. Five e.h.p. switchboard panels. (See this issue.)

Porthcawl (Glam.).—The Urban District Council is prepared to grant facilities for the installation and operation of an electricity supply scheme (public company) within its district. (November 16th.)

Southampton.—December 3rd. Electricity Department. Two e.h.p. switch cubicles with control panels and indicating diagrams, &c. (November 16th.)

St. Helens.—December 15th. Electricity Department. One 6,000-kW turbo-alternator with condensing plant and auxiliaries; two water-tube boilers, complete with superheaters, fan, &c. (See this issue.)

Stewarton.—Electric lighting installation for the housing scheme. Plans from Mr. W. Macrae, Town Clerk, Council Chambers, Stewarton.

Tullamore (King's County).—December 21st. Tullamore Electric Light and Power Co., Ltd. One 30-kW, 220-V, d.c. generator, complete, &c. Mr. S. O'Sullivan, engineer and manager to the company, Tullamore, King's County.

Walthamstow.—December 14th. Electricity Department. E.h.p. and l.p. feeder cables and l.p. distributor cables. (See this issue.)

Warrington.—December 17th. Electricity and Tramways Committee. Motors. (See this issue.)

*Further particulars can be obtained at the Department of Oversea Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Birmingham.—Corporation. Accepted:—
Three 1,750-kVA, single-phase, 33,000-V transformers.—Ferranti, Ltd.

Bradford.—Electricity Committee. Accepted:—
Two 1,000-kW motor converters for the new Sunbridge Road sub-station.—Bruce Peebles & Co., Ltd., Edinburgh, in face of the fact that foreign tenders were substantially below the British in price. This is the second occasion on which the Bradford Committee has taken this attitude, the object being to encourage British trade and to help in the alleviation of unemployment. Later, two more such converters will be required at Sunbridge Road, and it has been suggested that if this work could be put in hand immediately, though not immediately required, the Committee might secure a Government unemployment relief grant toward the cost.

Esher and Ditton.—Urban Council. Accepted:—
Installing electric light at the new Council Chamber (£115).—J. B. Marr and Co.

Harraton.—Parish Council. Accepted:—
Extensions to the public lighting at Peartree.—Ray Electric Co.

Scunthorpe.—The Scunthorpe and Frodingham Urban Council. Accepted:—
Bulk supply mains (£4,300).—Western Electric Co., Ltd.
Switchgear and panels (£344).—Ferguson, Pailin, Ltd.
Three 100-kVA transformers (£423).—Ferranti, Ltd.

Swinton and Pendlebury.—Urban Council. Accepted:—
300-kW rotary-converter, complete with transformer, starting gear, h.p. switchgear, and l.p. control panel (£2,475).—British Thomson-Houston Co., Ltd.

Worthing.—
Electrical decorative fittings for the "Rivoli" Kinema, which is being built in Capel Road, Worthing.—Sloan Electrical Co., Ltd. (agents for Messrs. Peyton & Peyton).

FORTHCOMING EVENTS.

South Wales Institution of Engineers.—Cardiff. Engineering Exhibition. November 29th-December 8th.

Salford Technical and Engineering Association.—Saturday, December 1st. At the Royal Technical College, Salford. At 6.30 p.m. Annual meeting.

Institute of Transport.—Monday, December 3rd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "Railways of To-day and To-morrow," by Mr. C. Travis.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, December 3rd. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Electrical Apparatus for the Deaf," to be opened by Mr. C. M. R. Balbi.

(North-Midland Centre).—Tuesday, December 4th. Informal discussion, British Electrical Development Association: "Domestic Electrical Apparatus."

(Western Centre).—Monday, December 3rd. At Swansea. Ordinary meeting.

(North-Western Centre).—Tuesday, December 4th. At the Engineers' Club, Albert Square, Manchester. At 7 p.m. Informal meeting. Discussion: "Notes on Installing and Maintaining Electric Motors," to be opened by Mr. B. Lakeman.

(Wireless Section).—Wednesday, December 5th. At the Institution, Victoria Embankment, W.C., at 6 p.m. Paper on "The Relation Between Damping and Speed in Wireless Reception," by Mr. L. B. Turner.

(North-Eastern Section).—Thursday, December 6th. At the County Hotel, Newcastle. At 7.15 p.m. Smoking concert.

Institution of the Rubber Industry.—Monday, December 3rd. At the Engineers' Club, W. At 8 p.m. Paper on "Accelerators," by Major V. Lefebure.

Society of Engineers.—Monday, December 3rd. At Burlington House, W. At 5.30 p.m. Paper on "Railway Surveying by Photography," by Mr. J. W. Gordon.

Institute of Transport (Inc.).—Monday, December 3rd. At the Institution of Electrical Engineers. At 5.30 p.m. Paper on "Railways of To-day and To-morrow," by Mr. C. Travis.

Electrical Society of Glasgow.—Tuesday, December 4th. At Glasgow. Paper on "Wireless," by Mr. N. Turner.

Roentgen Society.—Tuesday, December 4th. At the British Institute of Radiology, 32, Welbeck Street, W. At 8.15 p.m. Paper on "Modern Radiographical Technique," by Dr. L. G. Heilbron.

Institute of Marine Engineers.—Tuesday, December 4th. At the Institute, The Minories, E. At 6.30 p.m. Paper on "Spontaneous Ignition of Coal," by Mr. J. H. Anderson.

Institution of Civil Engineers.—Tuesday, December 4th. At the Institution, Great George Street, S.W. At 6 p.m. Ordinary meeting.

Batti-Wallahs' Society.—Wednesday, December 5th. At the Hotel Cecil. At 1 p.m. Reunion luncheon.

Edinburgh Electrical Society.—Friday, December 7th. At the Philosophical Institute, 4, Queen Street Place. At 8 p.m. Paper on "X-Rays," by Mr. W. Law.

Electrical Power Engineers' Association.—Friday, December 7th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "The Brush-Ljungström Turbine," by Mr. J. R. Hutchings.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We should be glad to learn the names and addresses of suppliers of—

EBONITE scrap.
Rubber shields for the protection of tumbler switches in damp places.
DUSTAW (or DUSTALL) vacuum cleaners.
PREMIER all-insulated Black Switch.

NOTES.

Silversmiths' Electric Furnace.—The latest development in the Sheffield silver trade, says the *Financial Times*, is the introduction of a rotary electric furnace for melting silver and nickel silver.

Appointments Vacant.—Distribution assistant, for the Kettering Urban District Council electricity department; jointer, for the Southend-on-Sea electricity department; combustion engineer, for the Manchester Corporation electricity department. (See our advertisement pages to-day.)

Electrical and Engineering Industries and Protection.—A statement appearing in *The Times* and other papers yesterday morning reports that the National Union of Manufacturers has received "definite promises" from a number of firms to employ additional workers as under, "on Mr. Baldwin's proposals to protect the home market becoming operative." The following appear in the list:—

	Extra Workers
C.A.V. Small Trades, Ltd., London ...	750 males
Telephone Manufacturing Co., Ltd., London	100 males and 200 females
Ward & Goldstone, Ltd., Manchester... ...	200 males and 350 females
General Electric Co., Ltd.	3,500 males and 1,500 females

The British Rubber Tire Manufacturers' Association, London, give 6,000 and the British Electrical and Allied Manufacturers' Association, London, 15,000 as the number of extra employés their members could take, without specifying male or female.

According to the *Financial News*, the British Engineers' Association has been circularising its members inquiring whether they are in favour of the Prime Minister's policy of protecting the Home market. It is stated that of the replies received up to Tuesday 81 per cent. were in the affirmative. In the *Export Journal*, published by the B.E.A. in November, it was stated:—"Only the other day, Mr. J. T. Brownlie, president of the Amalgamated Engineers' Union, stated to the representative of a Socialist journal, that the question of Free Trade or Protection did not interest him deeply and that he considered it significant that the wages of skilled workmen were highest in protected countries and that the most prosperous period of British industrial development was under the Protectionist system."

Institution of Engineering Inspection.—At the conversazione of the Institution, held on November 19th, when the presidential address was delivered, amongst the exhibits that were on view the General Electric Co., Ltd., showed "Geekoduct" adjustable grid-pattern switch and plug boxes; the grid enables the lid, plug, and switch to be adjusted to suit varying thicknesses of plaster, and a lip on the lid prevents the plaster entering the box when its lid is raised; a recessed bridge carries the switches in the multiple box, which can be removed from the box without disturbing the wiring. Another exhibit was the patent gland that is one of the chief features of the "Kingsway" water-tight surface-wiring system and, in addition to an electromagnetic intercommunication telephone, "White Osram," colour-sprayed, projection, and miners' lamps were shown.

The Singer Sewing Machine Co. showed an electrically-driven sewing machine, the motor of which is not an attachment, but built as an integral part of it; a speed up to 1,000 stitches per minute is controlled by light pressure on a knee lever.

The Moonbeam Engineering Co., Ltd., had on view a non-dazzle vehicle head lamp.

The Mullard Radio Valve Co., Ltd., showed various patterns of thermionic valves.

Messrs. Evershed & Vignoles, Ltd., exhibited the "Megger" family of testing sets, recording instruments, &c., and hand- and power-driven generators for radio transmission, the output of which is approximately 30 milliamperes at 1,000 volts when the rotor is revolved at a speed of 100 r.p.m.

Whitworth Commemoration Dinner.—The first commemoration dinner of the Whitworth Society will be held on Friday, December 21st (being the anniversary of the birth of Sir Joseph Whitworth, Bart.), in the Royal Venetian Room at the Holborn Restaurant, London, W.C.1. There will be a reception by the president, Dr. H. S. Hele-Shaw, at 7 p.m. for 7.30 p.m. We understand that a few seats are still left, but no tickets can be guaranteed after December 7th. Application is to be made to the hon. secretary, Whitworth Society, c/o The Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1.

New Degrees in Dublin University.—The Senate of Dublin University, meeting in Trinity College, Dublin, on November 23rd, decided to establish the following degrees:—Bachelor of Electrical Engineering (B.A.I. Elec.); Bachelor of Mechanical Engineering (B.A.I. Mech.); and Bachelor of Applied Science (Sc.B. Tech.).

Educational.—ROYAL TECHNICAL COLLEGE, GLASGOW.—The annual report covering the 127th session contains lists of the teaching and administrative staff; lists of students who gained distinctions during the session; particulars of classes, &c. The frontispiece is a portrait of Dr. Magnus Maclean, who recently retired from the Chair of Engineering.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Before the reading of Mr. Bachellery's paper on the "Electrification of the French Midi Railway," on November 22nd, the President (Dr. Russell) announced that the French Government had conferred the diploma of Officer of Public Instruction upon Messrs. C. H. Wordingham, C.B.E., and W. N. Twelvetrees (past president of the British Section of the Société des Ingénieurs Civils de France). M. Gueritte, who had received the decorations from the French Ambassador, made the presentation to Mr. Twelvetrees, who briefly acknowledged his appreciation of the honour. Mr. Wordingham was not present.

Informal Meeting.—At the meeting of the Informal Section on November 19th, Mr. J. R. Bedford was in the chair when Mr. A. B. Eason opened a discussion on "Electric Power in Telephone Exchanges." Batteries of 1,000 ampere-hours were quite ordinary, and an exchange now completing would have four batteries of 50 V, 1,000 amp.-hours. Mr. Eason showed lantern slides illustrating various exchanges and their details, also switchboards and connections. His account of the methods adopted to counteract vibration and the new universal practice in the Post Office of covering the battery acid with a thick film of oil were subsequently fully debated.

Mr. F. Gill said he first met with the use of oil to prevent accumulator spraying at Marseilles in 1919-20. The battery makers, however, objected to it, though he believed they were now satisfied that a suitable oil was obtainable, and had withdrawn their opposition.

Mr. F. Pooley said that the size and capacity of telephone batteries had so extended that the charging machine was now within the field of the ordinary large dynamo manufacturer.

Mr. A. F. Harmer had found compressed cork a success in absorbing vibration from machines.

Mr. A. G. Hilling thought the mercury-arc rectifier should be more used for charging, and pointed out that a floating battery required extra regulation and switchgear.

Messrs. P. Dunsheath, W. Day, W. E. Rogers, W. L. Wreford, and G. Wheeler also spoke.

A.M.I.E.E. Examination.—At the examination held last month the following candidates were successful:—

Passed Whole Examination.—Messrs. P. Andreas, G. S. Bailey, H. E. Barrett, J. W. Bellamy-Law, H. J. Boyland, J. Davies, J. D. Galliard, L. J. Godden, C. J. W. Peakin, F. Peasgood, E. E. Pidcock, H. M. Rostron, A. J. Sayers, C. M. Shaw, H. F. Smith, E. A. Stinchcomb, A. C. Tetley, F. W. J. West.

Passed Part I only.—Messrs. W. D. Brakenridge, E. W. L. Morley.

Passed Part II only.—Messrs. G. M. Buchanan, J. C. George, F. R. King.

The results relating to condidates who sat for the examination abroad will be published later.

The following officers of the Corps of Royal Engineers were successful: Lieut. A. B. Hayden, 2nd Lieuts. A. M. Anstruther, E. N. Bickford, E. H. W. Cobb, R. A. Conlay, W. J. Curry, P. J. L. Drewe, M. du B. Floyer, H. S. Francis, H. T. Heard, A. J. R. Hill, J. V. Jenkins, G. Malcolm, J. E. Marsh, C. F. W. Miller, R. S. Pain, L. A. B. Paten, L. E. C. M. Perowne, C. G. Stainer, R. F. E. Stoney, A. F. Toogood, B. E. Whitman, R. G. V. Wilbraham, G. A. D. Young.

Junior Institution of Engineers.—The meeting announced for December 7th at the Royal Society of Arts has been postponed to January 16th, 1924, at the same hall. Sir J. Fortescue Flannery, Bart., M.Inst.C.E., M.I.Mar.E., M.I.Mech.E., will then be inducted president of the Institution in succession to Capt. H. Riall Sankey, C.B., O.B.E., R.E. (ret.), and will deliver his address, "Marine Propulsion During Fifty Years." Tickets for the meeting, which commences at 7.30 p.m., may be obtained from the secretary of the Institution, 39, Victoria Street, London, S.W.1.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

St. Marylebone Borough Council Electricity Supply Committee has re-elected Ald. J. A. G. Beaumont chairman and elected Councillor H. P. Chick as vice-chairman for the ensuing year. The Committee recommends that the salary of Mr. C. C. Marsh, assistant generating engineer, be increased from £10 12s. 11d. to £11 12s. 11d. per week inclusive, subject to adjustments according to the cost-of-living figure.

The Government of Japan has conferred the second degree order of the Sacred Treasure upon General Guy E. Tripp, chairman of the Board of the Westinghouse Electric and Manufacturing Co. This is the highest decoration that can be awarded a civilian foreigner by the Japanese Government. General Tripp is in Japan at the present time in connection with reconstruction work following the recent severe earthquake, and his decoration was in recognition of his activities in assisting the Japanese officials in rebuilding the devastated area.

The Treasury has appointed Sir William Hepworth Mercer, one of the representatives of the Government on the Pacific Cable Board, to be chairman of the Board, in succession to the late Sir Henry Babington Smith, and has nominated Mr. M. F. Headlam, of the Treasury, to succeed Sir William Mercer as one of the British Government representatives on the Board.

Mr. P. J. Pybus, C.B.E., managing director of the English Electric Co. and well-known in Bradford by reason of his long connection with the Phœnix Dynamo Co., one of the concerns included in the English Electric combination, is the Liberal candidate for the Shipley Division, near Bradford.

Mr. H. Cuttle, of Ashton-under-Lyne, has been appointed by the Oldham Electricity Committee, out of 73 applicants, to the post of shift engineer.

The marriage took place on November 17th, at the Parish Church, Clophill (Beds.), of Mr. B. P. Turtle, son of Mr. Peter Turtle, electrical engineer, of Wandsworth, S.W., and Miss Elizabeth Juffs, youngest daughter of Mr. William Juffs, of Hall End, Clophill.

The marriage took place on November 15th, at the Ithon Road Presbyterian Church, Llandrindod Wells, of Mr. Clifford Wilde, resident engineer of the Llandrindod Wells Electric Light Co., and Miss Gwendoline Nicholls, of that town.

Miss Rachael Parsons, daughter of Sir C. A. Parsons, is to stand as Conservative candidate against Mr. Stephen Walsh, the miners' leader, in the Ince Division.

Sir William Clegg has been appointed chairman of the Sheffield Corporation Tramways Committee, and Ald. W. C. Fenton deputy chairman.

The French Minister of Public Instruction has tabled a Bill for a pension of 40,000 fr. (about £500) a year to Mme. Curie on the 25th anniversary of the discovery of radium, as "a national reward" to the distinguished scientist.—*Evening News.*

Obituary.—Mr. J. Smith.—The death took place on November 20th of Mr. Jabez Smith, J.P., head of the firm of J. Smith & Son, electrical engineers, of Market Place, Faversham, and High Street, Sittingbourne. He was 68 years of age, and had been in business at Faversham since 1878, and at Sittingbourne since 1889. He served on the Faversham Town Council for 15 years, was twice Mayor, and was a borough magistrate.

Sir Andrew Beattie.—The Right Hon. Sir Andrew Beattie, P.C., who died recently in Dublin in his 70th year, was associated with, among other companies, the Gosport-Alverstoke Electric Lighting Co., the Hampshire Light Railways (Electric) Co., the Provincial Tramways Co., Cardiff, and the Great Grimsby, Plymouth, and Portsmouth Tramway Companies. He took a very deep interest in electrical developments in both Great Britain and Ireland. Sir Andrew was a member of the Dublin Corporation and of several other public boards; was High Sheriff of Dublin in 1918; and was a D.L. and J.P. for the city.

Mr. T. Fogg.—Mr. Thomas Fogg, permanent-way engineer of the Lytham-St. Annes tramway undertaking, passed away last week at the age of 43 years, and was interred at Heywood on Friday last.

Mr. C. Evans.—The death occurred on Sunday last of Mr. C. Evans, aged 59, traffic superintendent of the Newport (Mon.) Corporation tramways.

The tragic changes that have taken place during the brief period of thirteen years in the closer circle of the electrical industry—at any rate in the ranks of any single family connected with it—are painfully brought to mind in the following "In Memoriam" notice that appeared in *The Times* on November 23rd:—"Byng.—In ever-loving memory of Gustav Byng, who died on November 23rd, 1910; and of his sons, Leonard, Harry, and Fred."

Mr. H. M. Lake.—Mr. Harold Miller Lake, aged 28 years, an engineer at the electric power station, Walsall, and a son-in-law of Councillor and Mrs. G. F. Macdonald, of Handsworth, was killed last Friday morning, as the result of a collision with a motor lorry. He was riding a motor-cycle at the time. The verdict of the jury was "Accidental death."

Mr. J. Dyer.—The death took place at Charlton, on November 16th, of Mr. J. Dyer, one of the early erectors of power-station machinery. He became associated in the early 'nineties with Dr. S. Z. de Ferranti at Charterhouse Square, and erected the first single-phase 10,000-volt alternators at Deptford. Following this he installed machines at Cardiff, Bolton, Blackburn, St. Helens, Sheffield, Edinburgh, Harrogate, &c. Later, we understand, he was the first erector in this country for the Westinghouse Co. of America, and erected a machine at Willesden for the Metropolitan Electric Supply Co., Ltd. He travelled to Spain for Messrs. Jessop & Appleby and erected cranes at Oporto, Gijon and Vigo. For a number of years he was employed as engineer for Messrs. Peek, Frean and Co., converting their machinery from steam to electric drive. He retired prior to the war, but returned to active service, being released from war-work to go to Lisbon to supervise the erection of machinery for the Portuguese Government. The deceased was 68 years of age. He leaves a son, Mr. A. V. Dyer, A.M.I.E.E., who is at present constructing the electrical equipment of a new light railway in Yorkshire.

NEW COMPANIES REGISTERED.

The West Riding Automobile Co., Ltd. (193,823).—Registered as a private company on November 16th with a nominal capital of £100,000 in £1 shares. The objects are:—To adopt two agreements with the Yorkshire (West Riding) Electric Tramways Co., Ltd., and to carry on the business of proprietors of omnibuses, cabs, &c. The number of directors is not to be less than three or more than seven; subject thereto the said company may, while holding three-quarters of the issued capital, appoint and remove directors, who shall not be required to hold any qualification shares. The first directors are:—Sir Herbert S. Leon, Bart., Bletchley Park, Bucks.; G. E. Leon, 31, Throgmorton Street, E.C.2; W. Murray, 101, Mount Street, W.1; E. Remnant, Beresford Lodge Hotel, Birchington-on-Sea; H. England, Belle Isle, Wakefield. Remuneration, £2,000 per annum divided between them. Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.2. No notice of situation of registered office was filed at the time of incorporation.

National Register of Electrical Installation Contractors (193,864).—The National Register of Electrical Installation Contractors (the word "limited" being omitted from the title by licence of the Board of Trade) was registered on November 19th as a company limited by guarantee, and not having a capital divided into shares, with 100 members each liable for £5 in the event of winding up. The objects are:—To afford to the public the means of distinguishing electrical installation contractors who have given evidence of their competency; to raise the efficiency and status of such contractors as a body in a manner consistent with the importance of their occupation, and in connection with the application and use of electricity for any purpose; to set up, issue, and maintain a register of contractors qualified for registration in Great Britain, the Irish Free State, and Northern Ireland, &c. The management is vested in a registration board, the first members of which are:—P. V. Hunter, C.B.E., Hamilton House, Victoria Embankment, W.C.2, engineer (vice-chairman); W. R. Rawlings, 95, Gloucester Road, South Kensington, S.W.7, electrical contractor; W. M. Selvey, 66, Victoria Street, Westminster, S.W.1, electrical engineer (consulting); C. H. Wordingham, C.B.E., 7, Victoria Street, Westminster, S.W.1, electrical engineer (consulting), chairman (nominated by the Institution of Electrical Engineers); S. E. Britton, 6, Glan Aber Park, Chester, electrical engineer; E. Calvert, 9, Dukes Avenue, Finchley, N.3, electrical engineer; F. W. Purse, 84, Romford Road, Stratford, E.15, electrical engineer; Lt.-Col. W. A. Vignoles, Nun's Cottage, Grimsby, electrical engineer (nominated by the Incorporated Municipal Electrical Association); H. J. Cash, Caxton House, S.W.1, electrical engineer; W. Cross, 22, Gowan Terrace, Newcastle-on-Tyne, electrical engineer; W. A. Shaw, 107, Princes Street, Southport, electrical engineer; H. Walton, 52, Cannon Street, E.C.4, engineer (nominated by the Electrical Contractors' Association); A. Lindsay, 173, Bath Street, Glasgow, electrical engineer and contractor; D. S. Munro, 11, Randolph Place, Edinburgh, electrical engineer and contractor; A. B. Robertson, Junr., 260, Union Street, Aberdeen, electrical engineer (nominated by the Electrical Contractors' Association of Scotland); A. E. Iliffe, 4, Central Buildings, Westminster, S.W.1, electrical engineer; H. W. Roberts, Magnet House, Kingsway, W.C.2, sales manager (nominated by the British Electrical and Allied Manufacturers' Association); H. J. R. Burstall, 14, Old Queen Street, S.W.1, consulting engineer; A. H. Dykes, 11, Victoria Street, Westminster, S.W.1, consulting engineer (nominated by the Association of Consulting Engineers); W. Harrison, 45, Parliament Street, S.W.1, engineer; P. M. Millns, 17, Whitefriars Street, E.C.4, electrical engineer (nominated by the Electrical Wholesalers' Federation); M. Clarke, 4, Queen Square, W.C.2, architect; A. E. Munby, 9, Old Square, Lincoln's Inn, W.C.2, architect (nominated by the Royal Institute of British Architects); A. G. Bruty, 7 and 8, Eden Quay, Dublin, electrical engineer and contractor; F. G. Sherwood, 35, Great Brunswick Street, Dublin, electrical engineer and contractor (nominated by the Irish Centre of the Institution of Electrical Engineers). Solicitor: T. Trimnell, 1, Lincoln's Inn Fields, W.C.2. No notice of situation of registered office was filed at the time of incorporation.

The Association of British Exhibitors (193,968) (the word "limited" omitted from the title by licence of the Board of Trade) was registered on November 23rd as a company limited by guarantee and not having a share capital, with an unlimited number of members, each liable for £1 in the event of winding up. The objects are:—To protect the rights and interests of companies, firms, and persons who make a practice of participating in exhibitions, shows, and trade fairs in Great Britain, Ireland, or elsewhere, &c. The management is vested in a Council, the first members of which are:—R. O. Ackerley, 36, Regent Square, W.C.1, exhibition manager, General Electric Co., Ltd.; C. E. Aldridge, 1, Blenkarne Road, S.W.11, salesman, Staines Kitchen Equipment Co., Ltd.; E. C. Balmforth, 44, Norton Road, Hove, manager, Cuirass Products, Ltd.; A. T. B. Kell, 45, Gower Street, W.C.1, managing director, Plaster Paint, Ltd.; W. J. McNab, "Revonah," The Grove, Radlett, Herts., manager, Noiseless Typewriter Co.; L. N. Mills, 102, Oxford Gardens, W.10, managing director, L. N. Mills & Co., Ltd.; F. Pascall, 158, Charing Cross Road, W.C.2, managing director, Interoven Stove Co., Ltd.; C. J. L. Percival, 40a, Golder's Way, Golder's Green, N.W., managing director, Physikurate, Ltd.; J. Ramsay, 32, Church Crescent, Finchley, N.3, assistant manager, Kiwi Polish Co. Proprietary, Ltd.; F. J. Robinson, 6, Buckingham Mansions, N.W.6, company director; W. E. Styles, 91, Forest Drive, West Leytonstone, E.11, managing director Autofex Engineering Works, Ltd.; A. W. Trevarthen, 15, South Park Road, Wimbledon, S.W.19, assistant manager, Spratts' Patent, Ltd.; A. Webber, 26, Colinton Road, Goodmayes, Essex, assistant sales manager, John Knight, Ltd.; G. J. Woods, 74, Colchester Road, Leyton, E.10, advertising manager, Allen & Hanburys, Ltd. Secretary: E. C. Balmforth. The registered office is at 69, Victoria Street, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Penarth Electric Lighting Co., Ltd. (52,912).—Return dated June 21st, 1923. Capital, £50,000 in 2,500 ordinary and 2,500 preference shares of £10 each. 500 preference and 2,500 ordinary shares taken up. £10 per share called up on the ordinary and £1 per share on the preference. £25,500 paid. Mortgages and charges, £15,937.

Rawlings Brothers, Ltd. (67,908).—Return dated September 29th, 1923. Capital, £100,000 in 70,000 ordinary and 30,000 preference shares of £1 each. 50,744 ordinary and 20,685 preference shares taken up. £71,429 paid. Mortgages and charges, nil.

Pope's Electric Lamp Co., Ltd. (101,293).—Return dated July 9th, 1923. Capital, £25,100 in 25,000 preference and 100 ordinary shares of £1 each. 23,579 preference and 100 ordinary shares taken up. £5,254 paid. £18,425 considered as paid. Mortgages and charges, nil.

Holophane, Ltd. (110,941).—Return dated November 12th, 1923. Capital, £105,000 in 100,000 ordinary shares of 1s. each and 100,000 preference shares of £1 each. 100,000 ordinary and 60,757 preference shares taken up. £15,207 paid on 15,207 preference shares. £30,550 considered as paid on 45,550 preference and 100,000 ordinary shares. Mortgages and charges, nil.

Rural Electricity Supply Co., Ltd. (107,281).—Return dated September 14th, 1923. Capital, £10,000 in 9,500 preferred shares of 1s. each and 10,000 deferred shares of 1s. each. 5,512 preferred and 5,713 deferred shares taken up. £3,269 9s. 3d. paid, being £2,871 on 2,871 preferred, £285 13s. on 5,713 deferred, and £112 16s. 3d. on 205 shares forfeited. £2,641 considered as paid on 2,641 preferred shares. Mortgages and charges, nil.

Cawnpore Electric Supply Corporation, Ltd. (84,233).—Return dated June 6th, 1923. Capital, £547,966 in 120,000 preference and 427,966 ordinary shares of £1 each. 81,493 preference and 158,507 ordinary shares taken up. £165,000 paid on 81,493 preference and 83,507 ordinary shares. £75,000 considered as paid on 75,000 ordinary shares. Mortgages and charges, £13,360 6 per cent. debentures, £250,000 5 per cent. debentures, free of income tax.

Dixon & Corbitt and R. S. Newall & Co., Ltd. (24,228c).—Return dated September 20th, 1923. Capital, £160,000 in £1 shares. All shares taken up. £96,150 paid. £63,850 considered as paid. Mortgages and charges, nil.

C. F. Young, Ltd.—Particulars filed of £1,000 debentures authorised October 13th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Upton & Garrett, Ltd.—Particulars filed of £160 debentures authorised November 5th, 1923, charged on the company's undertaking property, present and future, including uncalled capital, the whole amount being now issued.

British Engineering Units, Ltd.—Particulars filed of £500 debentures authorised October 31st, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

J. W. Barnard & Haynes, Ltd.—Issue on October 17th of £100 and on November 14th, 1923, of £100 debentures, parts of a series already registered.

CITY NOTES.

Cape Electric Tramways, Ltd.

Mr. L. Breitmeyer (chairman), presiding at the annual meeting, on November 21st, said that in spite of the general business depression in Cape Town and Port Elizabeth, the year's results had been very satisfactory. The number of passengers carried showed a net increase of 810,664, and while the revenue had fallen by £5,817, this was more than counterbalanced by reduced working costs, with the result that the net profit showed an increase of £9,378. New cars had been put into operation at Port Elizabeth, and others were on order for Cape Town. The chairman reviewed the accounts (*vide* ELEC. REV., November 9th, p. 709), and stated that Mr. J. B. Taylor, of the London board, had been appointed to the local board at Cape Town.

The report and accounts were adopted.

Marconi's Wireless Telegraph Co., Ltd.

The directors in their report for the year year ended December 31st, 1922, state that as many matters, frequently referred to on previous occasions, have not yet been settled, the accounts do not reflect the true strength of the company's position. The credit balance of the profit and loss account was £302,948. To this is added a balance brought forward from the last account, making a sum of £967,778, subject to corporation profits tax and income tax. From this the following dividends have been deducted:—7 per cent. on the preference shares, £17,500, and 5 per cent. on the ordinary shares, £137,500, leaving a sum of £812,778 available for distribution. The directors recommend payment of the following dividends:—10 per cent. on the ordinary shares, making 15 per cent. for the year; and 5 per cent. on the preference shares, making 12 per cent. for the year. It is proposed to carry forward the balance of £525,272.

Unsettled political conditions, unstable exchanges, and financial stringency continued to render working extremely difficult and restricted. None of the company's claims against Government departments, arising out of the war, has yet been settled. Negotiations are proceeding with the Chancellor of the Exchequer with a view to referring all these questions to a single arbitrator. The general meeting has been delayed as it appeared at one time that an agreement would be arrived at between the company and the Postmaster-General in respect of licences to conduct telegraph services with the Dominions, Colonies and foreign countries. Difficulties had arisen, however, in concluding such an agreement, and it was impossible to postpone the meeting further. A full statement will be made to shareholders when the agreement is made. The meeting is to be held at the Connaught Rooms, on Monday next (December 3rd).

Western Telegraph Co., Ltd.

The report of the directors for the year ended June 30th last states that the revenue amounted to £1,463,174, and the working expenses to £906,474. After providing £32,747 for debenture stock interest, and £196,711 for income tax, there remains a balance of £327,242. To this is added a sum of £200,000 transferred from the provision on account of investment fluctuations, and £114,392 brought forward from the previous accounts, making a total of £641,634. Four dividends of 2½ per cent. each have been paid, amounting to £311,895, making a distribution of 10 per cent., free of tax, for the year. The balance of £329,739 is carried forward. The meeting was held at Electra House, E.C., yesterday.

Southern Brazil Electric Co., Ltd. The annual meeting was held on November 21st. Mr. E. H. Tootal (chairman), who presided, referred to the sanctioning of the reorganisation of the company's capital, and said that the hopes entertained a year ago that it would be possible to continue the payment of interest on the debentures at the regular date had not been fulfilled, owing to the continued fall of the exchange value of the milreis, which was now slightly under 5d., the lowest depth yet reached. Although the actual currency profits showed a steady improvement, there had been a net loss of £8,982. The only compensation for the inflated state of the currency was the fact that planters were able to spend more money on electrical plant and current. It was to be hoped that the Brazilian Government would soon take energetic steps to deal with the currency problem.

Prospectus. *Bournemouth & Poole Electricity Supply Co., Ltd.*—This week the company published a prospectus offering 150,000 ordinary £1 shares at the price of £1 14s. each. The proceeds of the issue are required to repay the company's 7½ per cent. seven-year notes, amounting to £133,300, and for the "general requirements" of the company. The company has £187,500 of 4½ per cent. debenture stock outstanding.

Upon the opening of the list, the issue was oversubscribed many times in a very short period, and the list closed at 10 a.m.

Venezuela Telephone & Electrical Appliances Co., Ltd.—The profit for the year ended June 30th, 1923, was £29,430, plus £1,346 over-provided for E.P.D., making £30,776. Deducting £8,934 interest on debentures and loans, £1,358 income tax, £1,100 corporation tax, and £4,200 balance of discount on issue of first debentures, leaves £15,184. Dividend of 5 per cent. on ordinary shares for year proposed, placing £1,500 to first debenture sinking fund, £6,000 to reserve for renewals and depreciation, carrying £4,516 to undivided profits account. —*Financial Times.*

Calcutta Electric Supply Corporation, Ltd.—A progress statement shows that during the nine months ended September 30th, 1923, 49,041,435 kWh was sold, an increase of 10,532,545 over the corresponding period of 1922. The total kWh sold for the year 1922 was 51,598,579, so that the total for the first nine months of 1923 is not far short of the business of the entire year 1922. The first 15,000-kW turbo-alternator was brought into commission on June 29th, 1923, and the second will be in use very shortly.

British Electric Transformer Co., Ltd.—The trading results for the half-year ended June 30th, 1923, show a loss of £19,959, as compared with a profit of £9,266 for the same period of 1922 and £51,983 for the first half of 1921.

Melbourne Electric Supply Co., Ltd.—Final dividend on the consolidated ordinary stock of 5 per cent. actual, free of British income tax, making 10 per cent., tax free, for the year ended August 31st, 1923.

National Telewriter Co., Ltd.—Profit for the year ended June 30th, 1923, after paying interest on debentures, was £1,213.

Castner Kellner Alkali Co., Ltd.—Out of a net profit of £263,187 the directors recommend the payment of a final dividend of 12 per cent., making 20 per cent. for the year.

Pennsylvania Water & Power Co.—Regular dividend of 1¾ per cent., payable January 1st.

Power-Gas Corporation, Ltd.—Dividend at the rate of 4 per cent., less tax, for the year ended September 30th.

Globe Telegraph and Trust Co., Ltd.—Quarterly interim dividend of 5s. per share net on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

New issues are not to be deterred from appearing by the political ferment of the moment, and, where they offer good stock, there is no difficulty in securing a favourable reception. The Bournemouth and Poole Co., in offering ordinary shares at 34s., invited a very rapid subscription, seeing that the price of the existing shares in the market is 39s. It was very foggy on Monday morning, but in spite of this, the lists closed about eleven o'clock. Shareholders in the company are promised priority in the allotment, so it may be taken for granted that general members of the public are not likely to receive a great deal in the way of new shares.

In the market for electricity supply shares, the slightly downward tendency which has been perceptible of late, continues in evidence, although, at the moment, there is a little more buying. This change of front comes about as a result of the publication of the details respecting the position that has been reached between the companies and the L.C.C. Vague rumours are current as to trifling points, on matters of policy, not being entirely settled between two groups of the principal companies, but there is so much to be said in favour of giving the undertakings an extension of tenure that, apart from opposition which is to be anticipated from interested quarters, the success of the companies in obtaining an extra 40 years' life should be assured. Doubtless the issue of the General Election will have a good deal of effect upon this question, however, and, from the narrow point of view of electricity supply, the result will be extremely interesting.

Marconis have become a better market, in consideration of the company's announcement of a distribution of 10 per cent., making 15 per cent. for the year, the same as in 1922. Some people had been talking about a possible reduction in the rate, and the maintenance of the 15 per cent. therefore gives satisfaction. The meeting is to take place next Monday, and the directors are being urged to afford their fellow-proprietors all the information that is available in connection with the amount still outstanding, and due from the Government to the company, in connection with the latter's war service. Both sides, Post Office and Marconi, are no doubt taking a very firm stand upon their own particular points of view, but the dispute has been in abeyance for so long that the shareholder's attitude can be well imagined, and his impatience is not altogether surprising in view of the delay which has occurred in coming to terms.

Cable stocks are weak, falls having occurred in Eastern ordinary, and the three ordinary shares of the other members of this group. The heaviness is due to a shrinkage shown in the profits of the Western Telegraph Co. for the past year. The company maintains its 10 per cent. free of tax dividend, but the figures are not re-assuring to those whose nerves have been a little frayed during the past three months by the incidence of wireless developments. Consequently, the prices have given way, and the market as a whole is none too robust.

Another feature this week is the way in which Mexicans of all descriptions have gone ahead. The latest cablegrams state that by far the greater part of the money required for interest-payments in respect of coupons on Mexican Government bonds, is now in the hands of American banks. This has encouraged the conviction that the scheme, elaborated months ago, will become operative almost at once, and some people look for a distribution of interest in December, though it is more probable that the money will not be forthcoming until after the turn of the year. The mere fact of Mexico starting to pay off back interest is considered a bull point for everything connected with the country, and modest improvements have occurred in the utility bond issues, more particularly of those of the Mexican Electric Light and Mexican Light and Power Companies. Advances in Mexican Government bonds have been very much more substantial than those in the utility companies, which latter, of course, have yet to be provided for in the way of interest arrears. The general expectation is that some sort of funding scheme will be formulated for dealing with the overdue interest.

British Columbia Electric stocks are again stronger, because of the assumption that the forthcoming accounts will make an exceedingly good showing, though the Stock Exchange market does not expect that there will be any particular advance in the previously-paid dividends of 96s. per cent. on the preferred and 127s. per cent. on the deferred stocks. Anglo-Argentine Trams have halted in their upward stride, owing to the fact that there seems to be some doubt as to whether, after all, the trouble between the company and the Buenos Aires authorities has been entirely arranged. The prices of the shares hold their improvements, and there is some little demand for the company's 5 per cent. debenture stock. Whitehall Electric debenture at 96¼ shows a gain of the fraction.

Underground Electric issues are a better market, Metropolitans and Districts both improving strongly. The Stock Exchange carry-over this week showed that there is some shortage of stock in both cases. The Income Bonds of the Underground Railways have risen to 101¼, and the shares are also higher. Fresh inquiries have sprung up for the 4½ debenture stocks recently offered by the London Electric Railway and the City & South London. The discounts on these, which at one time touched 1½, have now run off to 12s. 6d. and 15s. respectively, both stocks being steadily absorbed. If precedent is anything to go by, it will not be long before there is none of either class to be obtained, because buyers of such securities are not of the class which effects a purchase of stock to-day in order to sell it to-morrow, next week, or even next year. The new Tata Power debentures, of both classes, stand at 2 discount.

Babcock & Wilcox have risen to 2½. Siemens hold their rise at 15s. The preference are better at 25s. 6d. General Electric ordinary are again a shade harder. The market for manufacturing issues is quiet, and there is not much going on. Iron and steel shares continue firm, the rubber market inanimate, but business as a whole in the markets of the Stock Exchange is better than might have been expected, having regard to the political excitements of the moment.

SHARE LIST OF ELECTRICAL COMPANIES.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Nov. 27, 1923.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Brompton Ordinary	£ 1	12	12	2½	— ⅛	£5 16 3
Charing Cross Ordinary	5	9	14	12¾	+ ¼	5 9 10
do. do. do. 4½ Pref.	5	4½	4½	4⅞	—	5 4 4
Chelsea	1	6	10	37/-	+ 1/-	5 11 1
City of London	1	14	15	49/6	—6d.	6 1 2
do. do. 6 % Pref. ...	1	6	6	94/-	—	5 4 4
County of London	1	8	10	2⅛	—	4 16 10
do. do. 6 % Pref. ...	1	6	6	20/-	—	5 3 3
Edmundson's Ordinary	3	Nil	7	4	—	5 4 10
do. 6 % Pref	5	12/-	6	5½	— ¼	5 14 3
Kensington Ordinary	5	10	12	10¼	—	5 16 5
London Electric	3	4	10	4⅛	— ⅛	6 1 7
do. do. 6 % Pref. ...	5	6	6	5¼	—	5 9 1
Metropolitan	1	7	8½	1⅜	—	5 4 7
do. 4½ % Pref.	1	4½	4½	17/6	—	5 2 10
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	15/-	—	3 6 8
do. 5 % Pref. ...	1	5	5	15/9	—	6 7 0
do. 7 % Pref. ...	1	7	7	23/-	—	6 1 9
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	17/-	—	Nil
do. 5 % Pref. ...	1	2½	5	⅞	—	6 17 0
St. James' and Pall Mall ...	5	13	14½	11½	— ¼	6 6 1
South London	1	7	10	1⅛	—	5 3 3
South Metropolitan Pref. ...	1	7	7	24/6	—	5 14 3
Westminster Ordinary	5	10	12	10½	— ¼	5 18 3
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/9	—	7 12 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	73	—	5 9 7
Metropolitan	,,	2½	3½	72½	+2	4 11 6
do. District	,,	1	3	55	+1½	5 9 1
Underground Electric Ordinary	10	Nil	Nil	2¾	+ ¼	Nil
do. do. "A" ...	1	Nil	Nil	9/9	+9d.	Nil
do. do. Income	Bonds	4	5	101½	+1½	*4 18 6
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	94/6	23½	—	6 9 0
Chile Telephone	5	6	6	6	—	5 0 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	16⅜	— ⅜	6 2 2
Eastern Tel. Ord.	Stock	10	10	164½	—3½	6 1 7
Globe Tel. and T. Ord.	10	10	10	17	— ⅜	5 17 8
do. do. Pref.	10	6	6	11½	—	5 7 7
Great Northern Tel.	10	24	22	28	—	7 17 2
Indo-European	25	10	7	31½	—	*5 11 1
Marconi	1	25	15	2¼	+ ⅛	6 13 4
Oriental Telephone Ord. ...	1	12	12	1⅝	—	*6 8 0
United R. Plate Tel.	5	8	8	6¾	+ ¼	*5 16 4
West India and Panama ...	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16½	— ½	*6 3 1
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams. First Pref.	5	5½	12½	3⅜	—	8 16 0
do. do. 2nd Pref.	5	Nil	6½	3½	—	9 16 0
do. do. 5% Deb.	Stock	5	5	78	+1½	6 8 2
British Electric Traction Ord.	,,	4½	5	70½	—1	6 19 10
do. do. 6% Pref.	,,	6	6	101½	—	5 18 3
Brazil Tractions	100	Nil	4	43	+1	9 6 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	5	90/-	93½	+2	*5 12 4
do. do. Deferred	,,	8	127/-	90½	+2	*6 7 6
do. do. Deb. ...	,,	4½	4½	77½	—	5 9 8
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	8/-	—	12 10 0
London United Tram. Deb. ...	Stock	4	4	59	—	6 13 4
Mexico Trams. 5 % Bonds ...	—	Nil	Nil	76½	—	6 10 9
do. 6 % Bonds ...	—	Nil	Nil	53½	—	Nil
Mexican Light Common ...	100	Nil	Nil	25	+1	Nil
do. Pref.	100	Nil	Nil	52½	—	Nil
do. 1st Bonds ...	—	Nil	5	67½	—	7 8 0
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	15	20	2¼	+ 1/32	*4 9 1
British Aluminium Ord. ...	1	10	5	17/6	—	5 14 3
British Insulated Ord.	1	15	15	2½	—	6 0 0
Callenders	1	15	15	49/6	—	6 1 2
do. 6½ Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Ord.	1	10	5	½	—	10 0 0
Edison-Swan	1	10	Nil	4/6	—	Nil
do. do. 5% Deb.	Stock	5	5	65	—	7 13 10
Electric Construction	1	10	10	29/6	—	6 15 7
English Electric	1	5	5	17/9	—	5 12 7
do. do. Pref.	1	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 3
do. Ord.	1	10	5	19/9	+3d.	5 1 3
Henley	1	15	15	2 7/16	— ⅛	6 3 0
do. 4½ Pref.	5	4½	4½	4½	—	5 2 10
India-Rubber	1	10	—	13/9	—	*7 5 6
Met.-Vickers Pref.	2	8	8	2½	—	5 19 0
Siemens Ord.	1	10	10	15/-	—	Nil
Telegraph Con.	12	20	20	25	—	*5 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Nov. 28.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	6d.	½d. inc.
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£32	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	½d. inc.
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£115 to £120	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£217	£14 inc.
Grade II ... ... ,, ,,	£185	£9 inc.
Grade III... ... ... ,, ,,	£85	£3 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	½d. dec.
c ,, Tubes (solid drawn) ... ,,	1/0 to 1/0½d.	...
c ,, Wire, basis ... ... ,,	10½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½d.	...
c ,, Bars (best selected) ... per ton	£95	...
c ,, Sheet ... ... ,,	£95	...
c ,, Rod ... ... ,,	£95	...
d ,, (Electrolytic) Bars ... ,,	£67 10s.	10/- inc.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£77 10s.	10/- inc.
d ,, ,, H.C. Wire per lb.	9 7/16d.	1/16d. inc.
f Ebonite Rod ... ... ,,	3/6	...
f ,, Sheet ... ... ,,	3/-	...
n German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	6/6	...
h India-rubber, Para fine ... ... ,,	1/0½	½d. dec.
i Iron Pig (Cleveland Warrants) ... per ton	£5 2s. to £5 2s. 6d.	...
j ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£32 5s.	10/- dec.
g Mercury ... ... per bot.	£9 15s. to £9 17s. 6d.	...
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/2	...
p ,, drawn bars and rods ,,	1/2½	...
p ,, rolled strip & sheet ,,	1/2½	...
p ,, wire ... ... ,,	1/3½	½d. dec.
o Platinum ... ... per oz.	£25	...
d Silicium Bronze Wire ... ... per lb.	1/0¾	¼d. dec.
r Steel, Magnet, in bars ... ... ,,	10d.	...
n Tin, Block (English) ... ... per ton	£236 15s. to £237 5s.	£16 10s. to £16 15s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/3	9d. inc.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Lifeboat Radio Apparatus.—Interesting experiments were carried out on the Thames between Gravesend and Margate on November 20th in connection with the fitting of radio apparatus to lifeboats, following an offer made by Mr. J. Havelock Wilson that the National Sailors' and Firemen's Union would test any apparatus that was brought forward. During a fifty-mile trip two sets were demonstrated. One of them, the invention of Captain F. G. Frost, weighed only 30 lb., and consisted of a "foolproof" box from which signals were transmitted by merely turning a handle. The other, demonstrated by the Marconi Co., was more elaborate. A number of representatives from associations connected with the marine service were present, and the Royal Air Force is also interested in the experiments, having already tested the Frost patent on aeroplanes. The machine demonstrated by the Marconi Co. was a quarter kilowatt quenched gap transmitter driven by a half horse-power petrol engine. It was both a receiving and transmitting set, and with the direction coil had the advantage of being able to find the position of a receiving ship. To work this machine an operator was necessary, whereas in the case of the smaller Frost set people who had no technical knowledge at all were able to send out perfect signals. The Marconi set took up the space and weight of about two men, and had a transmitting range of about 60 miles. Its receiving range in daylight was about 450 miles. The set patented by Capt. Frost was only 19 in. long and about 9 in. broad and deep. It was waterproof, and had a range of 60 miles. It required no accumulators or dry batteries, and worked on a small single aerial suspended between two masts. Certain parts can be changed and a Morse "tapper" put in for an operator to use.—*Morning Post.*

ELECTRICAL IMPORTS OF THE UNITED KINGDOM AND THEIR ORIGIN.

Statistics for 1921 and 1922 Compared.

An interesting view of the progress of British import trade in electrical machinery, apparatus, and appliances is afforded by the accompanying tables. They are based on the recently-issued official statistics and show the values of the imports of such materials, distinguishing the chief countries of origin. It will be noticed that Germany's imports of machinery were much larger in 1922 than in 1921, that French and Swiss imports also increased, but that those from the United States showed little variation. Our purchases abroad of cables and sundry apparatus and accessories declined in value in 1922 as compared with 1921, though probably not in quantity. Imports from both Holland and Switzerland fell off, as well as those from the United States, whilst Japan's contribution, which in 1921 and in the immediately preceding years were considerable, declined to an almost negligible amount in 1922. The reader may find it profitable to consider these tables in conjunction with the statistical review given in our Jubilee issue (ELEC. REV., November 17th, 1922) in an article entitled "Our Foreign Electrical Trade: Where Britain Buys and Sells Electrical Goods and Plant."

In a subsequent issue it is proposed to give similar analysis of the statistics of our export trade.

Imports into Britain of Foreign Electrical Goods.

(In thousands of £.)

Country of Origin.

	Total.		Germany.		Holland.		Belgium.		Switzerland.		Italy.		U.S.A.		Sweden.		France.	
	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.
Wires and cables, insulated :																		
Rubber insulated	43	127	5	58	12	7	16	16	5	20	1	—	1·5	0·5	—	—	—	—
Insulation other than rubber	105	90	28	34	10	12	4	27	—	—	10	—	33	5	—	—	15	5
Telegraph and telephone wires and cables, not being submarine cables	77	35	28	8	2	3	—	—	—	—	—	—	31	18	—	—	3·5	1
Telegraph and telephone apparatus :											Austria.							
Wireless instruments*	36	58	—	0·5	4	5	—	—	—	—	—	8	17	26	—	—	4	11
Other instruments	61	22	1	4	—	—	1	—	—	—	—	—	53	15	0·5	0·5	—	—
Other apparatus	211	206	5	10	—	—	10	13	1	2	—	—	174	156	8	5	6	15
									Spain.									
Carbons, lighting	51	16	12	4	—	—	—	—	9	2	8	5	12	4	—	—	—	—
„ furnace	35	28	—	—	—	—	—	—	—	—	—	—	30	27	—	—	—	—
„ other	9	2	1	1	—	—	—	—	—	—	—	—	7	1	—	—	1	—
Lamps, gas filled	126	49	—	—	92	26	10	2	—	—	22	12	—	—	—	—	—	—
									Switzerland.									
„ other	154	164	6	11	114	82	8	3	2	3	10	51	2	1	7	4	—	—
Batteries for hand flash-lamps	13	43	8	29	3	11	—	—	—	—	—	—	—	—	—	—	—	—
„ other	70	35	2	7	—	—	—	—	—	—	—	—	50	19	11	3	—	—
Accumulators, portable	26	12	9	3	—	—	—	—	—	—	—	—	—	—	3	7	13	—
„ stationary	11	42	—	6	—	—	—	—	—	—	—	—	1	1	—	—	9	34
Bell apparatus	10	16	8	14	—	—	—	—	—	—	—	—	1	0·5	—	—	—	—
Lighting accessories and fittings (including switches)†	217	167	76	95	8	6	5	2	11	9	—	1	46	32	1	10	12	9
Instruments, commercial (including ammeters, voltmeters, &c.)	77	28	1	6	—	—	—	—	39	7	—	—	33	10	—	—	3	3
Instruments, house service meters	53	26	—	—	—	—	—	—	24	12	—	—	13	1	—	—	9	2
„ scientific	5	15	—	3	—	—	—	—	1·5	0·5	—	—	3	10	—	—	—	—
Electro-medical apparatus	39	7	4	3	—	—	—	—	1	—	—	—	30	3	—	—	3	—
Other goods and apparatus	436	309	49	66	—	—	—	—	37	20	—	—	206	148	13	5	86	39

Total value of imports of electrical goods and apparatus, 1921, £1,931,000; 1922, £1,553,000.

* Hungary, 1922, £5,000. † Japan, 1921, £56,000; 1922, £500.

Imports into Britain of Foreign Electrical Machinery.

(Thousands of £.)

Country of Origin.

	Total.		Sweden.		Denmark.		Germany.		Holland.		Belgium.		France.		Switzerland.		U.S.A.	
	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	1922.	1921.	
Steam turbines, &c.	74	166	6	9	—	—	—	—	—	—	19	51	—	—	16	100	25	5
Water turbines	19	6	6·6	1	—	—	—	—	—	—	—	—	—	4	12	—	0·5	—
Generators, a.c.	61	359	15	0·6	10	9	—	28	—	—	—	169	2	34	30	117	3	1
Generators, d.c.	46	90	2	4	—	—	—	52	—	—	—	—	1·5	1·6	23	15	18	15
Motors, traction	13	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12	4
Motors, other, a.c.	109	64	42	24	2	4	9	10	4	1	1	6	—	—	10	1·	36	12
Motors, other, d.c.	143	117	19	7	5	2	22	13	11	5	3	2	2	2	12	22	65	61
Rotary converters	16	7	—	—	—	—	—	0·6	—	—	—	—	5·6	2·7	7	1	2	2
Transformers, static	22	31	—	3	—	—	—	1·7	—	—	—	—	—	3	14	17	4	5
Control and switchgear	4	15	—	—	—	—	—	—	—	—	—	—	—	—	—	12	2	—
Magnetos, ignition	3	10	—	—	—	—	0·7	1·7	—	—	—	—	—	—	—	—	1·5	7
Other electrical machinery	292	462	11	24	1	2	12	72	9	13	2	2	4	39	4	34	247	201

THE ELECTRIFICATION OF THE FRENCH MIDI RAILWAY.

By A. BACHELLERY, Ingénieur-en-Chef, Chemins de Fer du Midi, France.

(Abstract of paper read before a joint meeting of the INSTITUTION OF ELECTRICAL ENGINEERS *and the* BRITISH SECTION *of the* SOCIETE DES INGENIEURS CIVILS DE FRANCE.)

The electrification of the Midi Railway of France began effectively in 1902, when the company undertook the construction of a narrow-gauge line, 35 miles long, from Villefranche-de-Conflent to Bourg-Madame in the eastern Pyrenees, a single-track line climbing to an altitude of 5,000 ft., with long 6 per cent. grades and curves of 200 ft. radius. Electric traction was decided upon, and the chosen system was direct current, third rail, at 850 V. The line was opened in 1910, and has since worked to the entire satisfaction of the company.

Between 1908 and 1910 the single-phase system had made sufficient progress to be considered as practically reliable, and the use of overhead construction and a high voltage seemed to secure the most economical installations. In order to verify this through extensive tests, the company equipped 15 miles of line between Ille and Villefranche-de-Conflent. Six different systems of overhead construction—all based on the catenary principle—were effectively applied on this section. The type of current was single-phase, 16 cycles, 12,000 V on the contact wire. Six locomotives, built by different constructors according to the company's requirements, were submitted to a series of tests, and three of them, having successfully passed the tests, were accepted. It was accordingly decided to equip with the single-phase system 70 miles of double track between Pau and Montrejeau, and the single-track branch lines of Pierrefitte, Bagnères-de-Bigorre, Arreau and Luchon, measuring 63 miles. For this purpose a power house was built at Soulom equipped with six 2,500-kW generators.

The tests revealed serious trouble in the telegraph and telephone lines along the track, due to inductive interference by the single-phase traction current, but a solution was found which consisted in two extra wires run beside the trolley wire, namely: (1) A negative feeder along which the return current was forced by means of booster transformers, instead of going back through the track rails. (2) A counter-voltage wire in which there was an alternating voltage directly opposed to that in the trolley wire.

The outbreak of war brought these experiments to a standstill. The whole of the energy available from the existing power houses, as well as from a new 25,000-kW plant equipped at Eget during the war, was given over to munition work, and it was only after the armistice that the company could resume work in the matter of electrification. In the meantime, however, the French Government had decided to standardise for electric railways both the primary current and the traction current, in order that different power plants could work in parallel and that locomotives could be used indiscriminately on all the electrified lines.

In 1920 a Commission, after close investigation of the different systems in use in France and abroad, produced its conclusions, which were adopted by the Government. The primary current was to be three-phase, 50 cycles. The standard type of traction current was to be direct current at 1,500 V, with the proviso that, in exceptional cases, 3,000 V could be used. Either overhead or third-rail equipments were permitted, and locomotives were to be fitted with current-collecting apparatus suited to both.

These decisions implied for the Midi Co. the abandonment of the larger part of the work already done. Power plant, transmission lines, sub-stations, overhead equipment and locomotives had to be fundamentally modified to be used for the direct-current system. The company set to work immediately on these alterations as well as on a new programme of electrification. In two years' time, the first results have been attained by the appearance on the Pau-Tarbes division in the last months of 1922, of the first French 1,500-V, direct-current locomotives. The electrification work is actually carried out in the western part of the Midi system. The Toulouse-Dax line is to be entirely equipped this year, and is already partly run by electricity. Its branch lines are being changed over from single-phase to direct current. The equipment of the main line from Bordeaux to Hendaye has been begun, and also of the branch lines to Arcachon and Biarritz. Other lines will follow both in the Pyrenees and the Cévennes districts, the whole length of road to be electrified in the next 10 years being nearly 2,000 miles.

Current is produced in the two hydro-electric stations at Soulom and Eget, the first equipped with 21,000 and the second with 35,000 h.p., the latter from a fall 2,300 ft. high. In addition to this, the Midi Co. is building on the Gave d'Ossau three new power stations equipped for 130,000 h.p. with falls ranging from 600 to 2,500 ft. Other power plants are designed in the central and eastern Pyrenees for the time when electrification reaches those districts. The current produced by all these stations is three-phase, 50 cycles, at 60,000 V. It is transmitted by feeders following the railway, and in addition part of it is transformed to 150,000 V for long-distance transmission. Lines for this purpose are already constructed as far as Bordeaux and Toulouse. Their total length is actually 420 miles, and the longest distance between step-up and step-down transformers is 175 miles. Each line, designed to carry from 30,000 to 50,000 kW, consists of three copper cables each of 283,000 circular mils section. A steel earth wire is provided for protection. The cables are suspended by insulator chains of 9 plate-type elements from steel towers 66 ft. high and normally 660 ft. apart. Two of these lines, entirely independent of each other, join the Pyrenees to Bordeaux. Transformation from 60,000 to 150,000 V, and *vice versa*, is carried out in two step-up stations equipped for 60,000 kW, and in three step-down stations equipped for 80,000 kW. The latter are provided with synchronous condensers of 60,000 kVA total capacity. All these stations are of the outdoor type.

Energy for traction is distributed along the railway by 60,000-V feeders issuing either directly from the power plants or from the transformer stations. They are generally fixed to the same supports as the contact line. They consist of three 200,000 circular mil copper cables or aluminium equivalents. Sub-stations for converting three-phase current into direct current are built at distances varying from 8 to 20 miles, the drop in the line voltage not exceeding 20 per cent. under normal service. Different types of converting apparatus have been used. Besides the classical groups of two 750-V rotary converters connected in series, some sub-stations have 1,500-V, 750-kW rotary converters as single units. These are, the author believes, the first machines of this type wound for 50 cycles, and they have been entirely successful. They can withstand 200 per cent. overload during five minutes without flashing over. The newest feature, however, is the use, in some sub-stations, of mercury rectifiers producing 1,500 V, direct current. Five sub-stations have been equipped in this way, containing, in all, 16 groups each of 1,200 kW. Each group consists of a pair of cylinders connected in parallel, and fed with 12-phase current produced by special transformers. These rectifiers have proved very satisfactory.

All sub-stations possess high-speed circuit breakers on each group. In most of them, such high-pressure apparatus as transformers and oil switches is placed out of doors. The line equipment is of the double-catenary type. It consists of a steel messenger cable, of an auxiliary messenger, and of a contact wire, both of these made of 4/0 S.W.G. grooved copper. The auxiliary messenger is suspended from the main messenger by flat steel hangers 30 ft. apart on the straight and 15 ft. apart on curves. The contact wire is fixed to the auxiliary messenger by clamps maintaining the two wires in a vertical plane. On curves the catenary system is similar to that adopted on the Pennsylvania Railway. The line has no pull-offs, and follows the same curve as the track, the hangers taking an inclined position. This disposition gives a very smooth and uniform contact, and has the advantage of being self compensating when the temperature varies. On straight sections, pull-offs are generally used on the auxiliary messenger. Elastic pull-offs, consisting of two helical springs disposed V-wise, have been applied with success. On some sections, as an experiment, the pull-offs have been abandoned. In this case, the line is designed as a succession of curves staggered alternately 10 in. on either side of the middle of the track, and its tension is sufficient to prevent swinging. Up to now, this seems to give satisfaction. The distance between supports varies from 300 ft. on straight sections to 150 ft. on curves under 2,600 ft. radius.

Different kinds of supports have been tried. On single-track, the bracket type is generally used. On these supports are fixed the 60,000-V, three-phase distribution line, the 1,500-V, direct-current feeders and catenary line, and in addition, in some cases, a 10,000-V, three-phase line for auxiliary and signal service.

Protection of transmission and contact lines against excess of current or voltage has been especially cared for. The high-pressure lines are protected by selective relays and oil switches so disposed as to cut out automatically any section where a breakdown occurs. The system is, moreover, earthed at one of the power houses at the neutral point of a transformer. It is protected against pressure-rises by earthed reactance coils with iron cores, and against steep-front surges by Capart apparatus consisting of mica condensers branched between two inductive coils, one of which is shunted by a resistance. Direct-current machines in the sub-stations are protected, in addition to the oil switches and quick-acting circuit breakers, by inductive coils and by an earthing device composed of a condenser shunted by a resistance.

The best bonding arrangement used consists of a pair of short copper bonds, made either of cable or packed strips

connecting each end of the fish-plate with the corresponding rail.

The different lines to be electrified present very diverse features, including level main lines carrying fast passenger and heavy goods trains, branch lines to watering places where traffic assumes a partly suburban character, and mountain lines with exceedingly steep grades requiring very powerful locomotives. Nevertheless, the number of different types of locomotives has been limited to four.

The first electrical equipments were made in the English Electric Co.'s works at Preston, and the succeeding ones in the Lyons works of the Société des Constructions Electriques de France.

The first two types of engines are a passenger and a freight locomotive similar to one another except for the gear ratio. They are mounted on two 4-wheel motor trucks. Each of the four axles is driven by a geared nose-suspended motor. These motors, of Dick, Kerr design, with four poles and commutating poles, are wound for 1,500 V. Under forced ventilation, their one-hour rating is 350 and their continuous rating 250 h.p. The total weight of the locomotive is 72 tons; and the speed limits are 55 miles per hour for the passenger engine, and 40 for the freight engine. The motor control is the Dick, Kerr cam-shaft multiple-unit system. Different speeds are obtained through series-parallel and field-shunting combinations.

Low-pressure current for auxiliary service is produced by a 72-kW group. This includes, mounted on the same shaft, a 1,500-V motor, two direct-current generators and two fans for ventilating the traction motors. One of the generators produces 120-V current for the control circuits, for lighting the train, and for feeding the air compressor. The second one is a variable-pressure dynamo used for exciting the motor fields when regenerative braking is in action.

Each motor drives its axle by two symmetrical gears. In order to avoid axle breaking, each gear wheel, instead of being mounted on the axle, consists of a cogged rim bolted on to the truck wheel-centre.

The locomotive is equipped with both the Westinghouse automatic air brake and a straight air brake. Compressed air is provided by a Westinghouse gearless air compressor. In addition to these, an electric brake is provided. For the first machines, this was based on the regenerative principle, but experience has shown that the saving of energy resulting from regenerative braking is comparatively small, and does not justify the complication it introduces into the locomotive's equipment. It has, therefore, been abandoned for the future, and rheostatic braking adopted in its place.

The current-collecting apparatus has been designed with special care, in order to obtain a smooth contact and to avoid sparking. It consists of a pantagraph fitted with ball bearings at each joint. The collector is made of two steel pans lined with copper strips and borne on helical springs. By these means, the greatest flexibility has been realised and good collection obtained at all speeds.

Passenger trains are lighted and heated by current obtained from the engine through special couplers. The lighting current at 120 V is taken from the machine's auxiliary group. Heating is provided by 1,500-V current from the line. This current is sent into special radiators placed under the seats in the car compartments and protected by steel tubes and perforated steel plates.

A series of 90 of these locomotives is under construction, 11 of which are already running.

The freight locomotive is to haul trains up to 1,800 tons on the level. On mountain lines, this same engine can haul a 185-ton train on a 4 per cent. grade. A helping engine at the rear will be normally used on these lines. Another type of rolling stock is a motor-car for suburban and branch line services. It is carried on two 4-wheel bogies of the swinging bolster type. Each of the four axles is driven by a series nose-suspended geared motor. These motors are wound for 750 V and connected two in series. The continuous rating of each is 125 h.p., and the one-hour rating 175 h.p. The maximum speed is 50 miles an hour. The motor control is the same as on the locomotives. Air and hand brakes and electric rheostatic braking are provided. The car is entirely of steel. It includes a third-class compartment with central aisle and reversible seats, a luggage compartment and two drivers' platforms. The total weight of the vehicle is about 52 tons, and the number of seats is 48, besides which 32 standing passengers can be accommodated. These three types of stock are sufficient to haul any kind of train either on mountain or level lines, up to 50 miles per hour; but for higher speeds a special type of express locomotive had to be designed. In the case of an express locomotive, the ordinary gear transmission requires a high peripheral speed for the pinions, at which their lubrication becomes very difficult. This difficulty disappears in the gearless type of locomotive, where the motor armature is fixed directly on the driving axle; but then the unsprung load increases to such a point as to tell severely on the track. To lighten this, the motors are often set in the cab and connected to the axles by means of driving rods. But this construction generally results at high speed in abnormal vibrations of the machine and in stresses leading to breakage of rods, cranks, and even of the engine frame. In order to avoid these various difficulties, the Midi Co. has kept, for its high-speed locomotive, to the geared type, but with entirely suspended motors and quill drive. The particular feature is the use of a conical gear which allows smaller pinions and a lower peripheral speed and, moreover, is easier to lubricate than a straight gear.

Two locomotives previously built for use with single-phase traction were transformed according to this programme by the Société des Constructions Electriques de France. These have three driving axles independent of each other, and a 4-wheel bogie at each end.

The driving wheels are 69 in. in diameter. The adhesive weight is 54 tons, and the total weight 102 tons. The equipment of each driving axle is composed of a pair of vertical motors placed inside the cab and fixed to the main frame. The two pinions drive a double-cone gear-wheel fixed on the middle of the quill, and this in turn acts on the driving wheels through an elastic transmission. The six motors are wound for 500 V, and are connected three in series. They are 4-pole motors (two active and two consequent poles) with commutating poles. The one-hour rating of each is 375 h.p., that is, 2,250 h.p. for the whole machine. These motors, of very peculiar construction, have been designed and built at Liège, in the works of the Société des Constructions Electriques de Belgique, another firm associated with the Constructions Electriques de France. The motor control is of the same type as in the former machines, and the maximum speed is 75 miles per hour. No electric braking has been provided for these machines, which are only for level lines. They are fitted with the Westinghouse automatic and straight air brakes.

The current-collecting apparatus consists of three pantagraphs similar to those previously described, each of which can collect, without sparking, 800 amperes at the maximum speed. The locomotive has been tested up to a speed of 78 miles per hour, keeping perfectly steady on the track, without any nosing.

This type of locomotive has been adopted for a series of express machines to be built for level lines; but a new and more powerful machine of similar construction with four driving axles and a normal rating of 3,200 h.p. is already under consideration. It will pull on the level a 600-ton train at 60 miles an hour, or a 380-ton train at 70 miles. Although electric traction is already in use on 140 miles of the lines, it is still too early to give figures as to its cost, as only 37 miles are established under standard conditions, whilst several hundreds of miles are under construction. Nevertheless, in many ways, electrification has so far proved profitable. Not only do drivers of electric locomotives get lower wages than steam locomotive drivers, but also their daily run is 30 per cent. longer, on account of less time being spent for engine shed operations. As to the locomotives themselves, worked by several drivers they cover daily about 2.5 times the distance covered by a steam engine, which more than compensates for their higher price. The cost of hydro-electric energy is naturally much less than that of the coal it saves.

Important economies are also realised on engine shed and repair-shop expenses. On the whole, and in spite of the fact that most of the work was done under very unfavourable price conditions, there is every reason to be confident that the operation will prove profitable. A strong support to this belief is the rapid increase in traffic and revenue on the electrified lines, consequent on faster and more frequent trains. As a matter of fact, the technical advantages of electric traction are still more certain than the economical ones. It allows, especially on mountain lines, a higher commercial speed. For instance, on the main line from Bayonne to Toulouse, there is a grade of 1 in 30, 7½ miles long, which takes an express hauled by a steam locomotives 34 minutes to climb. The same train hauled by an electric locomotive gets to the top in 13 minutes. On the Transpyrenean lines long grades of four per cent. will be mounted by passenger trains at a speed of 25 miles an hour, whereas it is doubtful whether steam engines could work any effective service on such lines. Even on level lines train schedules can be made quicker, on account of a more regular and uniform speed being maintained by the electric locomotive, and of the suppression of those stops which are necessary only for taking in water. Trains can also be made more frequent without prohibitive cost. Electric traction will also prevent the costly fires which are started too often by locomotive sparks in the forest properties along the railway.

One of the greatest advantages, however, to be found in railway electrification as carried out in France is the construction of a close network of electrical transmission lines. In France, extensive areas are mostly agricultural and only to a small extent industrial. In such districts the demand for electrical energy could scarcely be sufficient to justify the high expense involved in long transmission lines. On the other hand, a great many railway lines, on account of limited traffic, require only a small proportion of the current which the high-pressure wires can carry, and this condition in general corresponds to cases where electrification could not be economical. In many cases the combination of these two unprofitable operations makes a profitable one, and the result will be not only to improve railway service con-

siderably, but also to bring cheap electric current to every town and to a large number of small localities.

When this is done on the 2,000 miles of road that the Midi Company intends to electrify, and when the Paris-Lyons-Mediterranean and Paris-Orleans companies have electrified some 3,800 miles in accordance with a similar plan, and when the last company has constructed the 300-mile 150,000-volt line from the Dordogne power plants to Paris, then not only railway electrification, but also public and industrial electrification, will have made a decided advance in France.

Discussion in London.

After reading his paper M. Bachellery exhibited a number of lantern slides depicting the electrification work in its many phases—line construction, power stations, sub-stations, rolling stock, &c.

Col. H. E. O'Brien, D.S.O., who opened the discussion, congratulated the author upon the way in which he and his colleagues had solved many difficult problems. The standardisation of current in France provided an example to this country. It was noteworthy that the railway company had been ready to abandon its single-phase working for the benefit of the country in general. It was to be hoped that the paper would lead to further progress in the electrification of British main-line railways. The author had stated that the technical advantages of electrification were more certain than the economical advantages. He hoped that the author would soon be able to say that the advantages were equally certain. There would soon be no difficulty in showing that the electric locomotive was a far more economical machine than the steam locomotive. Of course the low cost of energy in France had been a very decided incentive to electrification in that country.

Mr. E. M. Malee said that the French deserved great credit for the courageous way in which they had attacked the problem of electrification. The distribution of electricity (including railway electrification) had been studied as a whole, and not piecemeal. In addition, French engineers were noted for their ability to design reliable structures with minimum of weight.

Lieut.-Col. Cortez Leigh said that the methods adopted to overcome inductive interference in telegraph and telephone lines by the single-phase current seemed to be rather costly—the Swiss system of attacking the problem would appear to be cheaper. He considered that a higher pressure than 1,500 V might have been employed with the overhead system. He asked a number of questions relating to the carrying of 60,000-V lines on the same supports as the railway supply lines, and their effect. The author spoke of the adoption of short bonds, but Col. Cortez-Leigh said that the experience of the London & North-Western Railway engineers had shown that the long bond was more effective. There appeared to be no provision for emergency in the auxiliary lighting and heating system on the locomotives. In conclusion, he said that there was no doubt that the natural resources of France had provided a great impetus to railway electrification.

Mr. Theodore Stevens asked if the steel earth wire which was used really protected the system. Referring to the drop of 20 per cent. in the line voltage on the Midi Railway, the speaker compared this with the 12½ per cent. on the Chicago, Milwaukee, and St. Paul Railway, and 1½ per cent. on the Norfolk & Western Railway, and said that the expenditure on copper was dictated by circumstances. It had been said that with 11,000-V single-phase working sub-stations could be placed fifty miles apart, but on the Norfolk & Western Railway they were from five to seven miles apart. There were speed limits below which regenerative braking was not suitable. On the Paulista Railway (Brazil) there was no regeneration below 42 km. per hour for passenger trains, or 25 km. per hour for freight trains. Regenerative braking did not allow time for action on the part of the driver in case of emergency.

The speaker exhibited lantern slides to illustrate his remarks, and in particular showed that the return upon the electrification costs was greater in the case of short lines.

Owing to the lateness of the hour the author was left to reply through the medium of the *Journal*.

THE COMMERCIAL MOTOR SHOW.

Electric Vehicles Well Represented.

From the Ministry of Transport's register of licences of vehicles the growth of commercial motor transport since the war is made evident by an increase in registration from approximately 100,000 goods vehicles and 60,000 hackney vehicles in 1919-20, to 176,000 and 86,000 respectively in the present year. While a proportion of the increase is doubtless due to the disposal of ex-W.D. vehicles, the time has arrived when the demand for vehicles of modern design and of new construction is apparent, and from this point of view the Society of Motor Manufacturers and Traders was justified in organising the sixth International Commercial Motor, Transport, and Roads Development Exhibition at Olympia, with a view to showing the general improvement that has been made in the production of vehicles which are now an essential feature of the transport of goods and passengers. The show is one of the best it has been our pleasure to visit. It was opened on the 22nd inst., and closes on December 1st, covering exhibits of petrol, steam, petrol-electric, and electric battery vehicles, in addition to general accessories. A section of the exhibition, housed in the gallery of the New Hall, is devoted to roads development in connection with town and regional planning, and a pleasing feature of the vehicles displayed is the large number of models fitted with electric lighting systems.

Messrs. Stevens Petrol-Electric Vehicles, Ltd., show a 3-4 ton lorry fitted with a 40-50-h.p., 4-cylinder engine, having centrifugal pump water circulation, forced lubrication, a Claudel-Hobson carburettor, and variable speed by means of electrical transmission. A similar, but smaller chassis (2-2½ ton) is also shown.

The General Vehicle Co., Ltd.—The "Giant" 10-ton, 6-wheeler illustrated in fig. 1 is the first battery vehicle of its type and size to be tested in this country. It is built of standard parts throughout, is provided with Westinghouse air brakes and a "Martin rocking fifth wheel" turntable on the tractor, which has a quick release connection situated in the driver's cab, enabling the tractor to be easily withdrawn. It is spring loaded and allows the vehicle to conform to all road unevenness without interfering with the stability of the tractor; it is fitted with a box, detachable sides and tail door, and can be easily converted to a flat-platform type. (Mileage per charge, 35 to 40.)

The 3½-ton vehicle is equipped with an all-steel galvanised end-tipping body, of 9 cu. yd. capacity, designed primarily

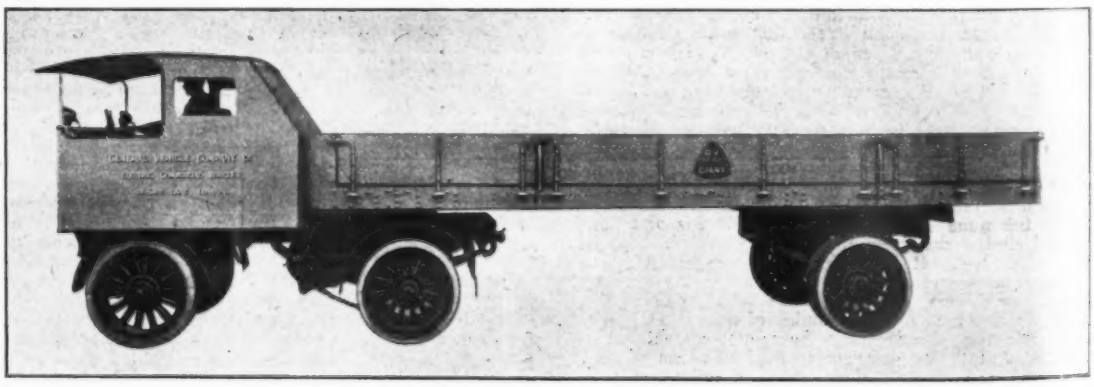


Fig. 1.—G.V. 10-Ton "Giant."

for house and trade refuse collection. The tipping gear is electrically operated, being controlled by a quick-brake reversing switch situated in the driver's cab. The 2-ton vehicle is fitted with a box van body designed for carriers. One of the features of this type of vehicle for parcel delivery work is the easy accessibility to the interior of the body through the driver's cab, thus enabling the delivery work to be carried out entirely by the driver.

The 2-ton "Baker" Hy-Lift" industrial truck has, in common with the two following vehicles, a 2-wheel drive and 4-wheel steering, and an auxiliary series-wound totally-enclosed lifting motor, raising the loading platform 72 in. The lifting gear is of the twin-cable hoist type, with automatic limit stop at each end of travel. Dimensions of loading platform, 54½ by 26 in. The platform of the 3-ton truck can be raised 15½ in. and is controlled by a limit switch. This truck can lift a heavy load in 10 sec.

The 10-ton "Baker" electric tractor has a speed without load of 6 miles an hour and with rated load of 10 tons, 4 miles an hour. When trailer trains can be employed to carry material this heavy-duty tractor gives the user the combination of tractive capacity, speed, and driving ease, thus eliminating hand trucking. Its overall length, including couplers, is 93½ in., width 41 in., height 59½ in., wheelbase 44 in.

Messrs. Walker Vehicles, Ltd., exhibit a standard 2-ton chassis, fig. 2, equipped with the "balanced drive," to which some reference was made on p. 610 of our October 26th, 1923, issue. In order to demonstrate clearly the action of the drive a separate back axle is exhibited, fig. 3, which is rotated

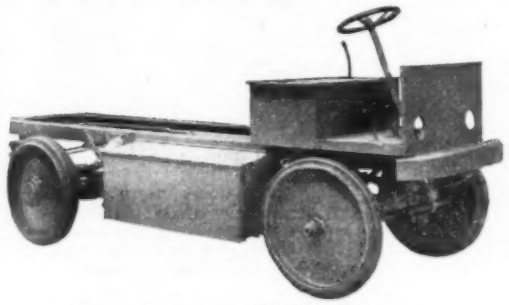


Fig. 2.—A Standard Walker Vehicle.

slowly, so that the movement of the idler gear wheels may be observed through the glass outer disks with which the driving wheels have been specially fitted. It is claimed to be the only drive in which unbalanced couples are eliminated. Power is transmitted in a steady manner from a single motor to the very rims of the rear wheels and the motor and transmission gear are totally enclosed and continuously lubricated,

Fig. 3.—A Balanced-Drive Rear Axle.

and comprise only ten moving parts, all rotating, *viz.*: one electric motor situated in the hollow rear axle; one differential connected direct to one end of the hollow armature shaft; two driving shafts extending from the differential sockets into the centre of each hollow rear wheel, with a pinion on the wheel end of each shaft; four idler gears, two in each rear wheel, mounted on the axle yokes; and two rim gears fastened to the inside of the wheel rims. The wheels are of steel disk type and are dirt and water-tight, and well over 95 per cent. of the power at the motor shaft is said to be actually transmitted to the road wheels.

Messrs. Ransomes, Sims & Jefferies, Ltd.—Amongst this firm's exhibits are an electric refuse collector having a load capacity of 5 tons and a chassis weight of 2 tons 17 cwt.; wheelbase 11 ft. 9 in. The battery consists of 40 IMV.12 "Ironclad-Exide" cells, capacity 387 Ah on the 5-hour discharge rate. The controller is of the series-parallel drum type, situated under the driver's seat, and the power is distributed to two motors connected by chains to the rear road wheels. The capacity of the type C.11 electric truck and stillage is 2 tons, and this weight can be easily dealt with by the elevating mechanism, which is designed to withstand continuous hard wear. The truck is steered on two wheels and is fitted with a 20-cell IMV.4 "Ironclad-Exide" battery, supplying current to two driving motors bolted direct to the swivel axles. The control of the truck is simple and suitable for traversing rough ground. The elevating gear is fitted with automatic knock-off gear, so that it is impossible to overrun it in either direction.

The 15-cwt. "Ransome" electric runabout crane travels, turns, hoists and derricks under its own power, derived from a battery. The crane is also able to turn on its own centre, and the wheel system is so constructed that the crane can readily adapt itself to uneven ground.

Messrs. Tilling-Stevens Motors, Ltd., have on view a petrol-electric, double-deck, London-type omnibus, mounted on a type T.S.7 forward-steering chassis, with petrol-electric transmission; worm final drive; nominal h.p. 40, four cylinders (treasury rating 32.4 h.p.); taking a maximum load capacity of 5 tons, including body; chassis weight 3 tons 14 cwt. The 48-seater body by Thomas Tilling, Ltd., has accommodation for 48 passengers, 22 inside and 26 outside; upholstery in moquette; fitted with Tilling-Stevens direct lighting system, in which the current is taken from the chassis dynamo. A similar type T.S.6 chassis, but weighing approximately 4 tons, and having a worm final drive, is also shown.

Messrs. Clayton Wagons, Ltd., show a standard 3½-tonner, the single motor and countershaft in one unit to ensure correct gear alignment. The controller is located beneath the driver's seat and provides five forward and two reverse speeds. Roller bearings and ball thrust collars are incorporated wherever necessary and the final drive is by means of two roller chains to the rear wheels. The end-tipping steel body is fitted with tipping gear of the "run-back" type, operated by an independent motor. The battery is an Exide, but customers can have their choice in this respect.

Messrs. C. A. Vandervell & Co., Ltd., exhibit a range of commercial vehicle electrical productions, embracing complete dynamo lighting and starting equipment for all types of commercial vehicles, 'bus-lighting equipment, as supplied to the L.G.O.C., electrical installations for fire engines, and special lighting equipment for steam-driven lorries. Also a new model switchboard is shown, which gives sole control of lighting from the main board, thus eliminating separate switches. The firm also makes illuminated advertising signs, together with complete equipment for illuminated advertising vans. Batteries incorporating threaded rubber insulation; lamps, embodying head, side, tail, inspection, interior, and dash types, and lamp bulbs, sparking plugs, and electric horns are also displayed.

Messrs. Clear-Hooters, Ltd.—Electric horns, the note of which is produced by magnetically vibrating the diaphragm instead of striking a diaphragm, which involves the consumption of a large amount of electrical energy in setting into motion heavy striking parts. In the case of the "Clear-Hooter" the current is used to move the diaphragm only, thereby eliminating all complicated mechanisms. A light rod is used to operate the make-and-break only, which is mounted on a hinge piece and is in the form of a substantially laminated trembler blade, the tension of which is distributed right across the blade by a tension piece. The tuning of the hooter is obtained by adjustment of two screws, one of which constricts the volume of sound and the other regulates the speed of the vibration.

The British Lighting & Ignition Co., Ltd.—A new electrolytic dynamo and battery regulator, lighting sets, magnetos, and accessories.

Messrs. Batteries, Ltd.—"Nife" nickel-iron alkaline traction batteries.

Simms Motor Units (1920), Ltd.—Magnetos and flexible couplings, sparking plugs, horns, lighting sets, &c.

Messrs. S. Wolf & Co., Ltd.—Portable electric tools.

Messrs. Brown & Co. (Luton), Ltd.—Electric horns, Ford commutator rotors, lamps, &c.

Messrs. North & Sons, Ltd.—"Watford" magnetos.

Messrs. S. Smith & Sons (M.A.), Ltd.—Electric lighting and starting equipment, lamps, M.-L. magnetos, sparking plugs and testers, horns, &c.

Messrs. Joseph Lucas, Ltd.—Electric lighting and starting sets, lamps, magnetos, &c.

Messrs. Rotax (Motor Accessories), Ltd.—Electric lighting and starting sets, batteries, cut-outs, switchboards, lamps, horns, &c.

Messrs. H. M. Hobson, Ltd.—Sparking plugs.

Messrs. Allen-Liversidge, Ltd.—Lamps, including the "Focus" head lamp, with an anti-dazzle attachment.

The Robinhood Engineering Works, Ltd.—Sparking plugs.

Anglo-Swiss Trade.—In a review of Anglo-Swiss trade in 1922, by the British Legation at Berne, it is shown that Great Britain retained her position as Switzerland's chief customer, the exports to this country amounting to 20 million Swiss francs, as compared with 16 million fr. in 1921. France was next with 14 million fr., as against 11 million. The two items of most interest to our readers were machines and vehicles, which decreased in value from 18.1 to 13.2 million fr., and instruments and apparatus, which showed a decrease from 4.5 to 4.1 million fr.

THE ALL-BRITISH WIRELESS EXHIBITION.—III.

MESSRS. L. MCMICHAEL, LTD., specialise in "M.H." receiving sets, which can be divided roughly into experimental receiving sets and "units" for the experimenter; broadcast sets; home assembly sets, and general accessories for all purposes.

The experimental sets comprise a complete range from a single detector valve panel (M.H.1.) to a 4-valve series comprising high- and low-frequency combinations. The "unit" system provides for the general user who has a preference for some system which can be added to, or subtracted from, enabling various combinations to be easily varied. Broadcast receiver and amplifier sets can be obtained either in separate cabinets or mounted together in sloping or covered cabinets, as required. For those who require extra range, an additional h.f. panel with tuned transformer coupling greatly adds to the range and selectivity of these sets. The "Everset" crystal receiver is designed for variometer tuning, and slight rotation will defintely reset the crystal. The instrument is tubular in form and of small but pleasing proportions.

The accessories include reactance capacity couplings and anode resistances of a new plug-in type, to enable resistance to be used for the higher ranges where duolateral coils normally take their place. Last, but not least, is the M.H.5 crystal detector wherein seven combinations of crystal are possible, two of them being crystal to crystal.

THE BOWYER-LOWE CO., LTD.—Amongst the numerous sets and component parts exhibited by the firm, the type C. wavetrap, shown in fig. 1, was noticed. It "cuts out the unwanted station," and is constructed on the lines laid down by Mr. P. W. Harris for use in conjunction with receivers in which the tuning condenser is in parallel with the tuning coil. The method adopted is to short-circuit the aerial and earth terminals of the receiver with a few turns of wire to which is tightly coupled an oscillatory circuit capable of being

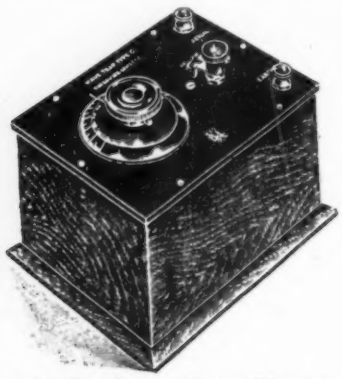


FIG. 1.—THE BOWYER-LOWE WAVETRAP.

tuned to the wave-length it is desired to receive, reception only being possible when the two circuits are exactly in tune with each other. The trap adjustment is, therefore, very sharp, and it is claimed that stations only five metres different from that being received can be entirely cut out. The instrument is mounted on polished ebonite in a mahogany case.

THE MARCONI SCIENTIFIC INSTRUMENT CO., LTD.—The portable receiver is one of the most recent of the M.S.I. products. It is entirely self-contained, the aerial being in the form of a loop, arranged round the inside of the lid, and the batteries and 'phones are fitted in special compartments. The accumulator is a non-spillable type, thus adding to the facilities for transport, and the case is made of leather, measuring 20 in. by 14 in. by 6½ in. The instrument employs six valves of the "V.24" type, three of which are used for h.f. amplification, one as a detector, and the remaining two as note amplifiers.

In the heterodyne wave meter the 150-4,000 metres wavelength range of the four coils is controlled by a 0.001 precision variable condenser. Two 4-V dry cells are incorporated inside the instrument. A pair of h.r. 'phones are included in the plate circuit so that the instrument may be used as a receiving or transmitting wavemeter, and a buzzer is incorporated so as to produce a tonic train if required.

M.S.I. five-valve cabinet receivers are designed for those who require "the utmost sensitiveness combined with simplicity of operation." They are capable of receiving all the B.B.C. stations, also, it is claimed, foreign telephone stations and (on favourable occasions) some of the American broadcasting stations can be clearly heard. The instruments employ two valves of the "V.24" type for h.f. amplification, one as a rectifier, and two as note magnifiers. The latter are connected through a three-position barrel switch so that three, four, or five valves can be used at will; a change-over switch is also provided for switching on to 'phones or a loud speaker. All the filament resistances are controlled by means of a main filament rheostat which also serves as a switch, and external connections are made by means of plugs so that no accidental mis-connections can be made. The instruments are enclosed in a cabinet with folding doors. The 2- and 3-valve cabinet sets are similar in design, while the cabinet-de-luxe set can be made to suit the particular period required.

THE STERLING TELEPHONE & ELECTRIC CO., LTD.—Amongst the many exhibits of this firm perhaps the new "threeflex" receiving set was the most interesting. It has been designed

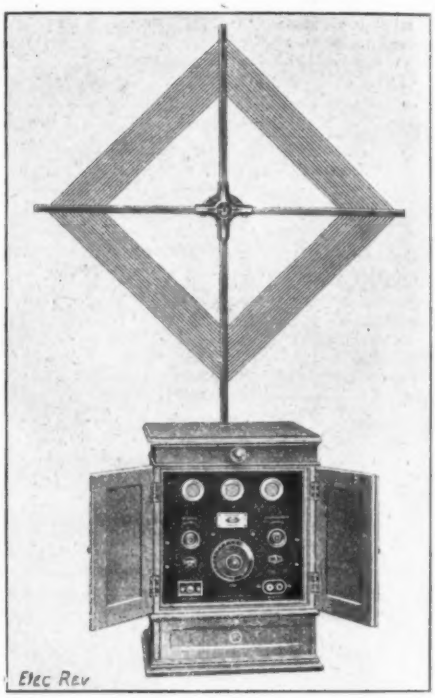


FIG. 2.—STERLING "THREEFLEX" SET.

for those who have no scientific knowledge of the subject and, as will be seen from fig. 2, is operated in conjunction with a portable folding frame aerial. Whilst its makers do not encourage extravagant claims they inform us that, subject to

FIG. 3.—STERLING CRYSTAL RECEIVER.

the set not being used in a "blind spot," or immediately under the shadow of a broadcasting station, it will (without further accessories) reproduce with excellent clarity broadcast telephony from all the B.B.C. stations. Further, it will operate a loud-speaker with ample volume at considerable distances from any particular transmitting station. Another feature is that D.E.8 valves are employed, so that the set

erates entirely by means of dry cells, and the aerial frame n be easily rotated from the front of the cabinet by means a conveniently-placed handle. To facilitate this operation compass is let into the top of the set. A novel feature is at the shutting of the doors switches off the valves, thus reventing waste of current.

The variometer-tuned crystal set is illustrated in fig. 3; it fitted with an enclosed "semi-automatic" crystal that permits rapid adjustment and extra inductance for the reception Paris time signals. Like other Sterling sets it is mounted a patent metal panel that is claimed to act as a screen ainst disturbance. Fig. 4 shows the firm's 4-valve long-nge receiver. The normal wave-range of the instrument is om 250 to 550 metres; this can, however, be increased by the ddition of suitable anode reaction and plug-in aerial coils. he valves are arranged as follows: the first is a igh-frequency amplifier, the second a detector, and the ird and fourth, low-frequency amplifiers; the fourth valve power transformer-coupled, fitted for grid battery control, d thus permits the use of a power valve at this stage. The erial tuning is accomplished with a variometer; the coupling etween the first and second valves is obtained by the tuned-

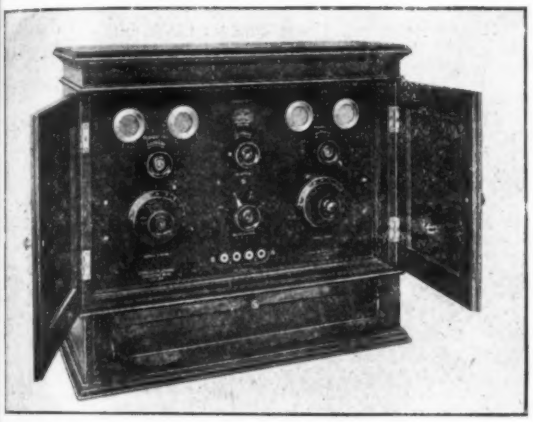


Fig. 4.—Sterling 4-Valve Set.

anode method, and reaction is introduced by coupling the anode circuits of the two valves. A variable air condenser unes the anode circuit, has a "vernier" adjustment, and plates of special shape, which give uniform variation of wave-ength.

Messrs. S. G. Brown, Ltd., exhibited a variety of head-phones, microphone amplifiers, and loud-speakers incorporat-ing the "centre-pull" principle. The reproducer consists of an aluminium cone-shaped diaphragm anchored at its centre to the end of a vibratory reed, which is actuated by the pas-sage of current through two coils on the ends of the magnet poles above it. This method of construction is claimed to reduce the distortion that an iron diaphragm attracted simul-taneously by both poles of an electro-magnet, as in a tele-phone-type of receiver, is liable to produce. A new product is the "Crystavox" loud-speaker" shown in fig. 5, that can be operated directly by a crystal receiving set with the aid of a 6-volt dry battery only. The set is tuned in the ordin-ary way, while final adjustment of tone is made by means of a magnetic device in the base of the "Crystavox." It is desired to correct the impression that this device is on sale at the moment. While the work of production is proceeding we understand that deliveries to the trade cannot be antici-pated for another three or four weeks.

Several models of the "Frenophone" were also to be seen on this firm's stand. It is the invention of Mr. S. G. Brown, F.R.S., and as a loud-speaker is notable for the originality of its mode of operation.

The instrument is illustrated in fig. 6, and derives its name from the Latin word *frenum*, meaning a "bit" or "curb"; for in its operation the grip of a glass disk upon a small pad of cork is applied by means of silk reins to a telephone dia-phragm. The principle employed is that of friction, the grip, or drag, being made to vary in a vibratory manner by the speech currents in a small telephone receiver, and the result-ing vibratory changes in the drag cause a diaphragm to be set in motion.

To produce the necessary friction the glass must be kept in motion; it is, therefore, made in the form of a disk which is rotated by a clockwork motor. The glass is lightly treated with a tacky solution to augment the friction between it and the little cork-faced steel pad which lies on its surface. The pad is kept in place by the reins which anchor it to the dia-phragm, and to a securing pillar by means of a light spring. The pressure of the pad on the glass is derived from the reed of a telephone earpiece of the Brown type (hinged after the manner of a gramophone sound box). When the reed vibrates as a result of currents in the coils of the telephone the vibra-tions are imparted to the pad by the attaching stylus, or pin, causing the pad to be more or less dragged to-and-fro by the motion of the glass surface under it. The diaphragm, in

Fig. 5.—The "Crystavox" Loud-speaker.

Fig. 6.—The "Frenophone."

turn, receives this varying pull, and sets up trains of sound waves through the trumpet to which it is attached.

Messrs. Abbey Industries, Ltd.—Amongst a range of re-ceiving sets and accessories on this firm's stand the smallest crystal set in the show was noticed. It is excellently made, and is said to be the smallest model passed by the G.P.O. authorities. When used in conjunction with a standard P.O. aerial it has a guaranteed range of 15 miles for broadcast telephony and of 200 miles for spark signals, with a wave-length range of from 350 to 700 metres—and can be carried on the palm of the hand.

Binary-Fluid Turbines.—Correction.—The author of the article on this subject, which appeared in our last issue, is Mr. William J. Kearton, and not "Keaton."

LEGAL.

B.T.H. Lamp Patents.

In the Chancery Division on November 21st, Mr. Justice Romer heard a motion by the British Thomson-Houston Co., Ltd., for an injunction restraining the Express Motor Accessories Co. from infringing its patents for electric incandescent lamps.

The defendant company's representative was present, and expressed his willingness to have the matter disposed of on the motion. He said he bought a few of the lamps and did not know that he was doing wrong.

His Lordship granted the injunction asked for, with an inquiry as to damages if necessary, and costs.

In the Chancery Division on November 22nd, a procedure summons in the action by the British Thomson-Houston Co., Ltd., against the Midget Lamp Co., Ltd., was mentioned to Mr. Justice Romer, and there was some discussion as to the possible effect of the judgment in the action, British Thomson-Houston Co., Ltd., *v.* British Insulated & Helsby Cables, Ltd., now being heard by Mr. Justice Russell.

The question in this summons was the length of time which the defendants should be allowed for an application to the Attorney-General for his fiat for the delivery of their counter-claim.

His Lordship: I suppose there are a great number of actions which depend upon the decision that will be given in the case now being heard by Mr. Justice Russell?

Mr. Trevor Watson (for the plaintiffs) said there were a great many possible decisions. If the decision was not in favour of the plaintiffs, it did not follow that the other actions would be governed by it.

His Lordship: Are you anxious that all the other actions should be pressed on pending judgment?

Mr. Watson: Not so far as the court of first instance is concerned. This procedure has been adopted in a number of cases. When the decision has been given, if there is an appeal there may be further delay. If the plaintiffs in Mr. Justice Russell's case obtained a decision in their favour it would not be reasonable that all these actions should be held up.

His Lordship said he did not propose to allow the counter-claim in the present case to be delivered without the fiat of the Attorney-General, because on the question of principle he was convinced that he had no power to do so.

Mr. Watson: I shall ask your Lordship to give a decision at some stage on the question of principle.

His Lordship: I will do so, but the application had better stand over until after judgment in the case now being heard by Mr. Justice Russell.

Johnsen & Jorgensen Flint Glass, Ltd., v. Colbran.

In the Mayor's and City of London Court, on November 22nd, plaintiffs, glass manufacturers, of Farringdon Street, E.C., claimed £22 8s. 7d. against Mr. John B. Colbran, Crown Lane Works, Manor Park, for nine cases of opalescent electric glass globes supplied. Defendant said he bought the globes to supply to Messrs. Lipton, and that when they were delivered nearly half the globes were cracked or broken. Some of them cracked while on the shelves without being touched, which, in his view, showed that they had not been properly annealed. He did not complain of the material of which the globes were made. Plaintiffs said that when the globes were delivered to the defendant they were not cracked, and the breakages must have occurred in transit or after they had reached the defendant's hands. An expert had reported that the amount of strain on the globes when tested was quite negligible for practical purposes, and the annealing might be considered satisfactory.

Judge Shewell Cooper said that he ought to find for the plaintiffs for the full amount, as he must hold that the globes were merchantable, but he suggested that they might make an allowance, though he did not press it. Plaintiffs said they would take £15, and judgment was entered accordingly for them for that sum, and costs.

Action against Ealing Corporation.

Alleged Breach of Electricity Act.

Mr. Justice Romer, in the Chancery Division, on November 23rd, had before him a motion by the Attorney-General for an injunction restraining the Corporation of Ealing, until judgment or further order, from either completing the installation of a new electricity generating plant, or operating or using the plant when completed, without the consent of the Electricity Commissioners.

Mr. Farwell, K.C., appearing with Mr. Dighton Pollock for the Attorney-General, said the allegation was that in breach of the provisions of the Electricity Act, 1919, the defendants had extended their generating plant without the consent of the Commissioners, which consent was necessary. There might be two answers to that, *viz.*, (1) that the defendants had not extended their plant, and (2) that even if they had the work was done, and the defendants were supplying electricity, and if an injunction was granted it would plunge Ealing into darkness. In spite of that, he would ask for an injunction, though his Lordship might think fit to suspend its operation, so as to prevent inconvenience to the residents of the borough. Mr. Farwell said the matter was of some importance as there were other cases in which the same circumstances had arisen.

His Lordship said that obviously, the operation of any injunction granted would have to be postponed. He did not see any object in granting an injunction and postponing it until after the trial of the action.

Mr. Farwell: I should only ask your Lordship to suspend it until some arrangement can be made. My submission will be that the defendants are doing a directly illegal act. If that is so, we are entitled to apply for an injunction, which we desire to have granted, but in such terms as will protect the public from inconvenience.

His Lordship said that he could only assist by granting a speedy trial.

Mr. Hughes, K.C. (for the Corporation) said that defendants only desired to do their duty to the ratepayers. He was proceeding to explain that the Corporation had some general ing plant that was obsolete, and had substituted some new plant, when Mr. Farwell objected to Counsel's going into the merits of the case before he (Mr. Farwell) had had an opportunity of stating the case for the Attorney-General.

His Lordship said he would grant facilities for a speedy trial, adding that Mr. Farwell could apply early next sitting for a date to be fixed.

Carnival Chocolate Co. v. The Dumbrill Plant Co.

In the Shoreditch County Court, before Judge Cluer, on November 26th, the plaintiffs sued the defendants to recover a sum not exceeding £50. Defendants counterclaimed £28. The dispute arose out of the supply of a chocolate-mixing machine, the motor of which was alleged to be unsatisfactory. Plaintiffs stated that they had specified and paid for a "G.E.C." motor, whereas they had been supplied with one of inferior make. Defendants denied that a "G.E.C." motor was specified, and said that the machine supplied was not inferior. They were suing for the reutrn of the machine or the balance of the account. A witness for the plaintiffs admitted that nothing was said about a "G.E.C." motor on the invoice received from defendants. Judge Cluer gave judgment for defendants on the claim, and also on the counterclaim, the amount to be £28, to be reduced to £5 10s. upon the return of the machine in proper condition, in three days.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd.

On November 21st, this case was continued.

Cross-examined as to the Hammersmith process which has been inspected, Dr. Oberlander maintained that the 1909 process was the factory process of to-day.

Sir Duncan Kerly: The steps of the reduction were not the precise steps of the 1909 patent?—Witness: The 1909 patent does not give any precise steps. It recommends reductions of about 4 per cent., and says that in some cases considerably higher reductions have been successfully used.

Had you ever seen a mould like the mould at Hammersmith used before 1909?—Personally, I had not.

Witness was cross-examined in detail as to the various stages of the process, and Sir Arthur Colefax asked if the cross-examination was directed towards an allegation of insufficiency.

Sir Duncan Kerly: I am making no attack on sufficiency except the specific matter set out in my pleadings.

Asked whether he agreed that the precise factory process was not described in the 1909 specification but was something which had been developed since, witness said he did not agree with the form the question took. He thought that the process was described.

The working out of the highly developed process that we saw at Hammersmith was all subsequent to the 1909 patent?—No, I do not agree. It is all in the 1909 patent. It is working the 1909 patent which gives the success. Further improvements have been made which have been gradually embodied in it.

When did you see the 1909 patent as you understand it put into operation?—I think, in 1911.

The developed process as a whole is the subject of the American patent?—I have said so, yes.

Witness was re-examined by Sir Arthur Colefax, and said it was really harmful in the working of tungsten to follow the prior knowledge of metals other than tungsten.

The hearing was resumed on the following day.

Re-examined, Dr. Oberlander stated that in the Hammersmith process there was not in any single instance a substantial departure from the invention described in 1909.

The next witness called by plaintiffs was Prof. Thomas Gray, D.Sc., Professor of Chemistry at the Royal Technical College, Glasgow. He stated that for the last 20 years he had been in touch with industrial operations, and had visited many works in which chemical and metallurgical operations were carried on, and engineering shops devoted to the construction of chemical plant. He had a general familiarity with the methods of working metals, and he first came into contact

with tungsten in a coherent form when the Just and Hanaman filament was introduced into this country, about 1909. Witness first heard of drawn tungsten late in 1908 or 1909, when experiments were actually going on.

Mr. Hunter Gray: When did you first have practical work to do with the working of tungsten?—A little over a year ago, when I inspected plaintiffs' process from start to finish at plaintiffs' works at Rugby. Witness regarded as the most remarkable feature of plaintiffs' invention, the announcement that tungsten could, by a process of mechanical working, be converted into an extremely ductile metal, which could be worked and drawn through dies at ordinary temperature. He knew of no other metal, the ductility of which was improved by mechanical working.

Do you find in the 1909 specification fully described processes for rendering this brittle tungsten ductile cold?—Yes, I do. I find it described with so much detail that there is no difficulty in carrying out that invention and reaching the ultimate result which the inventor claimed. The idea was perfectly new to me, and as I regard it, quite revolutionary.

Witness agreed that as tungsten was worked while hot as by hammering, rolling, or the like, it progressively changed in some peculiar manner, and after a certain amount of working it took up such physical or molecular structure or characteristics as would permit mechanical working at room temperatures. Cold working with other metals rendered them less ductile, and more brittle.

Dealing with the directions in the specification for the elimination of the oxide of tungsten, witness said he knew of no other prior document in which any such precaution was set out. The oxide prevented the consolidation of the material. It was a sound direction to keep clear of the oxide particularly in the body of the tungsten. Comparing the plaintiffs' process with the built-up filament, witness said it was obvious that the possibility of manipulating long lengths of wire must reduce the cost of manufacture enormously. He did not find in the 1906 specification any indication that the resulting product was ductile cold.

Cross-examined, witness said that tungsten had a melting point two or three times higher than that of steel.

On November 23rd, re-examined as to his inspection of defendants' works, Prof. Gray said that the material he saw there had a marked degree of ductility cold, but it could be improved by further working. He found nothing in the 1906 specification indicating that it had been found possible to obtain tungsten ductile cold.

Sir Duncan Kerly said he was not asserting that the 1906 specification told them that the result of the process was tungsten ductile cold. It was not his case.

Mr. John Dixon Brunton, a partner in the firm of Bruntons, wire and wire rope manufacturers of Musselburgh, next gave evidence. He said he had never heard of any element other than tungsten which when raised to the annealing temperature and again allowed to become cold was brittle, and could not be worked cold. One of his employés had failed in attempting to draw sintered tungsten sticks supplied by Dr. Oberlander. It was the heating of the tungsten in the 1909 specification, and the small reductions, which impressed him. It had always been accepted that wire drawing was reducing the diameter of a metal cold.

Mr. Albert Catiles, chartered accountant and manager of Messrs. Price Waterhouse & Co., said that his firm were plaintiffs' accountants. He had examined the gross sales by the plaintiffs, and their licensees under the patent, and the total sales from January 1st, 1914, to March 31st, 1923, were 146,867,198 lamps. These were all tungsten-filament lamps.

Sir Duncan Kerly said that the lamps sold under the 1906 patent were included.

Mr. Hunter Gray: I have no doubt they included them.

On November 26th, evidence was given by Mr. David Murdoch, an employé of Messrs. Bruntons, of Musselburgh, as to his unsuccessful attempts to draw tungsten. He came to the conclusion that it was not possible to draw it in that crude state.

Mr. Thomas Alfred Gimingham, a Member of the Institution of Electrical Engineers, vice-chairman of the Electric Lamp Manufacturers' Association of Great Britain, and technical director of the Edison Swan Electric Co., Ltd., gave evidence as to the manufacture by that firm of carbon filaments, and afterwards squirted tungsten filaments. They were very discontented with the latter process, and were constantly looking out for something to supersede it. They first heard that drawn tungsten wire was being produced in America. When they heard of the discovery, they began experimenting with tungsten. At the commencement of 1912, they heard that tungsten wire was being drawn in Germany, and they had an offer from Germany to teach them the process. They took the opportunity with both hands, and were eventually in possession of the complete process for making tungsten wire ductile cold. They then gradually changed over their manufacture of tungsten filaments from the squirted process to the drawn wire process. The Edison Swan Co. was a licensee under the 1909 patent, and the process learnt from the German gentleman seemed to him exactly similar to the operations described in the 1909 specification.

Mr. George White, B.Sc., assistant to Dr. Oberlander, gave evidence as to his experiments in the drawing of tungsten under the 1909 specification.

Mr. Hunter Gray, K.C., summed up on behalf of plaintiffs, and submitted that the 1906 specification was full of conundrums which were insoluble, whereas the 1909 specification was a unique document containing complete instructions for carrying out the process described. Dealing with infringement, he said defendants had used a tungsten wire which had been rendered substantially ductile cold by someone else.

Sir Duncan Kerly, opening defendants' case, said the action was something entirely new in patent cases. It might contain new law, and it certainly had a new human aspect. Here they had plaintiffs owning a string of patents, deliberately electing to sue on the 1906 patent, alleging that it worked, and now coming to the Court with different experts to tell a different story from that told in the Duram case. Having maintained that the 1906 patent was perfectly good they now said the 1909 patent was the really important thing, and that they were entitled to a monopoly. Dealing with the Murdoch experiment, Counsel said he was going to suggest that Murdoch succeeded. He was operating at a temperature at which he would have succeeded if he had had the proper apparatus. Defendants' case was that there was no subject matter for the 1909 patent. At the most it was a mere discovery of a consequence of working to produce the result which was there indicated, and it was a necessary consequence. His next point was that Claim 1 of the 1909 specification was open to the objection that it was only the application of a known process. The 1906 patent, he said, did disclose an effective process for drawing tungsten wire. He attached no commercial importance to the cold ductility of the wire. It might be convenient to draw the last two stages cold, but defendants did all the drawing hot because it paid better.

The case is proceeding.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sexton-Jones, O'Dell and Stephens, Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

28,287. "Utilisation of electrical energy." D. Bellegrandi and F. Luscia. November 9th.

28,288. "Dynamo-electric machines." H. Barnes and English Electric Co., Ltd. November 9th.

28,289. "Dynamo-electric machines." English Electric Co., Ltd., and G. Schroeder. November 9th.

28,298. "Electron discharge devices." British Thomson-Houston Co., Ltd. November 9th. (United States, November 29th, 1922.)

28,299. "Electric discharge devices." British Thomson-Houston Co., Ltd. November 9th. (United States, November 11th, 1922.)

28,300. "Electric discharge devices." British Thomson-Houston Co., Ltd. November 9th. (United States, December 21st, 1922.)

28,301. "Regulating systems." British Thomson-Houston Co., Ltd. November 9th. (United States, February 10th.)

28,302. "Electric engravers." British Thomson-Houston Co., Ltd. (General Electric Co.). November 9th.

28,326. "Reception of wireless telegraphy, &c." R. A. R. Dalton. November 10th.

28,331. "Wireless receiving apparatus." G. Hopkinson. November 10th.

28,337. "Ignition plugs." R. Bosch Akt. Ges. November 10th. (Germany, November 11th, 1922.)

28,346. "Automatic selecting switches for telephone exchange systems." Western Electric Co., Ltd. (G. Deakin). November 10th.

28,347. "Electrical transmitting systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 10th.

28,352. "Adjusting instruments for wireless telegraphy." C. J. Owen. November 10th.

28,358. "Dynamo-electric machines." J. E. Calverley, English Electric Co., Ltd., and W. E. Highfield. November 10th.

28,359. "Dynamo-electric machines." English Electric Co., Ltd., and G. Schroeder. November 10th.

28,371. "Surface condensers." British Electrical and Allied Industries Research Association, D. V. Onslow, and E. B. Wedmore. November 10th.

28,373. "Control of dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). November 10th.

28,374. "Electric motor control." British Thomson-Houston Co., Ltd., H. C. Hastings, and E. B. Tuppen. November 10th.

28,380. "Electrical apparatus." J. J. Bell. November 10th.

28,382. "Electro-magnetic relays, &c." Measurement, Ltd. November 10th. (France, January 12th.)

28,383. "Protecting arrangement for winding of transformers, &c." Measurement, Ltd. November 10th. (France, January 27th.)

28,384. "Relays for polyphase circuits." Measurement, Ltd. November 10th. (France, February 22nd.)

28,385. "Relays for alternating currents." Measurement, Ltd. November 10th. (France, April 4th.)

28,389. "Electric lampholders, &c." D. E. Barnett. November 10th.

28,394. "Tuning devices for wireless telegraph apparatus." R. W. Tarrant. November 10th.

28,401. "Resistances." O. Klaerbje. November 10th.

28,402. "Starting resistances for electric motors." O. Klaerbje. November 10th.

28,408. "Inductances for wireless telegraphy, &c." B. Hesketh. November 12th.

28,427. "Grid leak fittings for wireless telegraphy, &c." D. S. B. Shannon. November 12th.

28,453. "Diaphragms for electric batteries." M. Wilderman. November 12th.

28,460. "Insulating panels for mounting or wiring electrical apparatus." A. H. Brettell. November 12th.

28,462. "Electric conductor rails." C. Jones. November 12th.

28,463. "Electrolysis." Siemens & Halske Akt. Ges. November 12th. (Germany, November 15th, 1922.)

28,465. "Multiplex signalling systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). November 12th.

28,466. "Carrier wave transmission systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 12th.

28,481. "Anti-dazzle device for head-lights." F. Evans. November 12th.

28,491. "Manufacture of filaments for electric lamps, &c." W. R. Bullimore. November 12th.

28,492. "Manufacture of filaments for electric lamps, &c." W. R. Bullimore. November 12th.

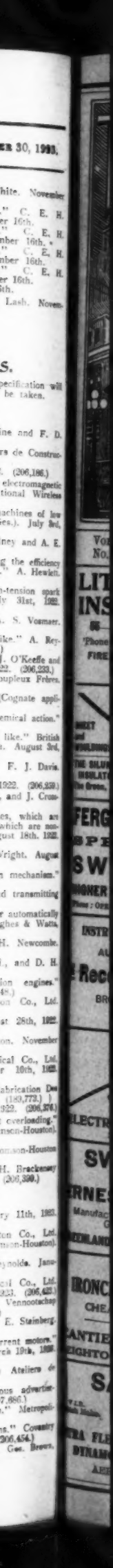
28,493. "Manufacture of filaments for electric lamps, &c." W. R. Bullimore. November 12th.
28,494. "Electron-emitting cathodes." W. R. Bullimore. November 12th.
28,497. "Thermionic valves, &c." L. A. Levy. November 12th.
28,499. "Electric relay apparatus." W. J. Brown, C. R. Burch, E. J. E. Hubbard, Metropolitan-Vickers Electrical Co., Ltd., and E. Y. Robinson. November 12th.
28,501. "Optical-electric measuring of distances." J. E. Pollak (Maschinenbau Akt. Ges. Seebach). November 12th.
28,502. "Optical-electric measuring of distances." J. E. Pollak (Maschinenbau Akt. Ges. Seebach). November 12th.
28,503. "Optical-electric measuring of distances." J. E. Pollak (Maschinenbau Akt. Ges. Seebach). November 12th.
28,520. "Windings of high-voltage transformers." Akt. Ges. Brown, Boveri et Cie. November 12th. (Germany, November 24th, 1922.)
28,522. "Radio warning systems for vehicles." H. Flurscheim. November 12th. (France, December 5th, 1922.)
28,525. "Thermionic valves, &c." L. A. Levy. November 12th.
28,531. "Apparatus for driving dynamos." W. S. Boughey. November 12th.
28,533. "Electric storage batteries, &c." A. Kur. November 13th.
28,538. "Ignition plugs." R. Bosch Akt. Ges. November 13th. (Germany November 13th, 1922.)
28,547. "Electric induction motors, &c." I. M. Chippindale. November 13th.
28,552. "Crystal detectors." J. J. Morch. November 13th.
28,561. "Electric terminals or connectors." A. J. Boddington and D. Boddington. November 13th.
28,563. "Commutator." H. Dinsdale. November 13th.
28,569. "Inductance coils for wireless telephony, &c." L. G. Russell and A. T. Thomspon. November 13th.
28,572. "Detectors for wireless receiving apparatus." L. Benson. November 13th.
28,591. "Telephone systems." J. E. Collyer, Coventry Automatic Telephones, Ltd., and C. W. Wilman. November 13th.
28,592. "Telephone exchange systems." Coventry Automatic Telephones, Ltd. (Arter). November 13th.
28,593. "Telephone systems." J. E. Collyer and Coventry Automatic Telephones, Ltd. November 13th.
28,633. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. November 13th. (United States, March 14th.)
28,635. "Circuit arrangements for telephone systems." W. G. Patterson and Siemens Bros. & Co., Ltd. November 13th.
28,637. "Dynamometers." L. F. R. Fell. November 13th.
28,638. "Crystal detectors." R. W. Robins. November 13th.
28,639. "Variable grid leaks." R. W. Robins. November 13th.
28,642. "Wireless inductance holders." Abbey Industries, Ltd., H. Melrille-Smith, and S. J. Tyrrell. November 13th.
28,653. "Anti-dazzle electric bulb." W. Phillips. November 14th.
28,670. "Crystal detectors." W. P. Harris. November 14th.
28,673. "Electric oven light." F. T. Bouckley and W. H. Leeson. November 14th.
28,679. "Alternating-current electric motors." T. W. Broadbent and F. W. Davies. November 14th.
28,680. "Terminal for electric wires." W. J. Saunders. November 14th.
28,691. "Electric motors, dynamos, &c." C. J. Bond and W. Harding. November 14th
28,696. "Detachable electric connection devices." Highfield Electrical Co., Ltd., and F. W. Highfield. November 14th.
28,710. "Carrier transmission systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 14th.
28,723. "Electric signalling systems." A. D. Cowper. November 14th.
28,724. "Electric signalling systems." A. D. Cowper. November 14th.
28,728. "Apparatus for translating pressure variations into electric variations." Westinghouse Electric and Manufacturing Co. November 14th. (United States, November 14h, 1922.)
28,732. "Electric terminals." S. M. Sydenham. November 14th.
28,750. "Telephone transmitters, &c." British Thomson-Houston Co., Ltd., J. H. Butcher, and A. P. Young. November 14th.
28,752. "Automatic, &c., telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. November 14th.
28,753. "Arrangements for charging accumulators." Automatic Telephone Manufacturing Co., Ltd. November 14th.
28,763. "Electric amplifiers." W. H. Priess. November 14th.
28,769. "Low-tension electric rotary distributor." R. C. P. West. November 14th.
28,770. "Apparatus for reception of wireless telephony, &c." G. Moody and H. G. Wright. November 14th.
28,780. "Electric wall plugs." J. B. Tucker. November 15th.
28,782. "Crystal detectors, &c." M. Koopman. November 15th.
28,789. "Spark plugs." R. Steinacher. November 15th.
28,790. "Electrically-controlled lock for railway-carriage doors." H. C. Baker. November 15th.
28,792. "Crystal detectors." J. J. Morch. November 15th.
28,801. "Adjustable coil mountings for wireless telegraphy, &c." W. G. Heatly and S. Ward. November 15th.
28,840. "Circuit for the reception of wireless signals." W. E. Ellis and T. G. Weatherhead. November 15th.
28,850. "Sound-producing or transmitting diaphragms." R. E. Crowther. November 15th.
28,853. "Diaphragm for electrolytic processes." P. Reinhardt et Cie. November 15th. (Germany, November 28th, 1922.)
28,854. "Switch-operating mechanism." F. Bergmann and Igranic Electric Co., Ltd. November 15th.
28,859. "Armature windings for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. November 15th. (United States, November 23rd, 1922.)
28,860. "Electric relay switch." G. Dumont. November 15th. (Belgium, December 8th, 1922.)
28,884. "Variable condensers." British Thomson-Houston Co., Ltd. (General Electric Co.). November 15th.
28,886. "Head lights for motor-cars, &c." L. Forse. November 15th.
28,889. "Safety devices for low-tension electric circuits." I. Guiducci. November 15th.
28,906. "Flexible tubes for telephones, &c." A. Marr. November 16th.
28,908. "Wireless sets." G. B. Walker. November 16th.
28,932. "Dynamo-electric machines." M.-L. Magneto Syndicate, Ltd., and E. A. Watson. November 16th.
28,945. "Stuffing boxes for use in cable manufacture." Western Electric Co., Ltd. November 16th.
28,946. "Electric switches." J. Backus. November 16th.
28,947. "Contacts for electric switches, &c." A. P. Stockings. November 16th.
28,948. "Electric overload switch, &c." A. P. Stockings. November 16th.
28,957. "Electrical indicators." M. M. Houghton. November 16th.
28,958. "Rheostats and potentiometers." M. M. Houghton. November 16th
28,967. "Electric switches." A. C. W. Aldis. November 16th.
28,975. "Telephonic receivers." E. A. Graham. November 16th.
28,979. "Magneto-electric machines." British Thomson-Houston Co., Ltd., L. Griffiths, and A. P. Young. November 16th.
28,980. "Current collectors for dynamo-electric machines." E. Breivogel, British Thomson-Houston Co., Ltd., and C. A. Martin. November 16th.
28,981. "Electric resistance." C. F. Trippe and S. D. White. November 16th.
28,987. "Electrically-illuminated advertising devices, &c." C. E. H. Fitch, Scintillating Sign Co., Ltd., and F. H. Waye. November 16th.
28,988. "Electrically-illuminated advertising devices, &c." C. E. H. Fitch, Scintillating Sign Co., Ltd., and F. H. Waye. November 16th.
28,989. "Electrically-illuminated advertising devices, &c." C. E. H. Fitch, Scintillating Sign Co., Ltd., and F. H. Waye. November 16th.
28,990. "Electrically-illuminated advertising devices, &c." C. E. H. Fitch, Scintillating Sign Co., Ltd., and F. H. Waye. November 16th.
28,994. "Crystal detectors." R. J. Willis. November 16th.
28,999. "Means for disinfecting telephone mouthpieces." S. Lash. November 16th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1922.

8,670. "Electrical switches and wall plugs." L. J. Lepine and F. D. Denner. April 25th, 1922. (206,170.)
15,135. "Direct-current circuit breakers." Forges et Ateliers de Constructions Electriques de Jeumont. March 31st, 1922. (195,340.)
15,452. "Electric clocks." C. E. Prince. June 1st, 1922. (206,186.)
18,080. "Selective and anti-parasitic receiving system for electromagnetic waves and electric currents of constant frequency." International Wireless Appliances Corporation. August 29th, 1921. (185,397.)
18,248. "Alternating-current commutator dynamo-electric machines of low stator frequency." P. C. Rushen (Siemens-Schuckertwerke Ges.). July 3rd, 1922. (206,194.)
20,810. "Alternate-current electricity meters." M. J. E. Tilney and A. E. Salisbury. July 29th, 1922. (206,214.)
20,811. "Apparatus for testing the condition and improving the efficiency of the high-tension spark circuit of internal-combustion engines." A. Hewlett. July 29th, 1922. (206,215.)
20,838. "Apparatus for testing the efficiency of the high-tension spark circuit of internal-combustion engines." A. Hewlett. July 31st, 1922. (206,216.)
20,925. "Rectifier with vibrating contact member." E. A. S. Vosmaer. August 1st, 1921. (183,860.)
20,972. "Electric transformers, reactance coils, and the like." A. Reyrolle & Co., Ltd., and W. Hanna. August 1st, 1922. (206,226.)
21,032. "Inductances used in high-frequency circuits." M. J. O'Keeffe and Dickinson Electrical Manufacturing Co., Ltd. August 1st, 1922. (206,233.)
21,041. "Amplification of sound by microphones." Soc. Coupleux Frères. May 8th, 1922 (197,285.)
21,136. "Sparking plugs." H. Ford. August 2nd, 1922. (Cognate application 4,497/23.) (206,240.)
21,173. "Electrical systems and apparatus for inducing chemical action." W. J. Rickets. August 3rd, 1922. (206,241.)
21,259. "Safety devices for electric winding engines and the like." British Thomson-Houston Co., Ltd., W. J. Pool, and C. J. H. Trutch. August 3rd, 1922. (206,244.)
21,576. "Sleepers for railways, tramways, and the like." F. J. Davis. May 2nd, 1923. (206,254.)
21,794. "Telephone receivers." A. Orling. August 10th, 1922. (206,259.)
22,094. "Electric battery." T. P. Hilditch, H. J. Wheaton, and J. Crossfield & Sons, Ltd. August 14th, 1922. (206,269.)
22,562. "Apparatus for separating coke or other substances, which are good conductors of electricity, from ashes or other substances which are non-conductors or bad conductors of electricity." H. Lelarge. August 18th, 1922. (206,273.)
22,790. "Bush for electric tubing and conduits." R. Wright. August 22nd, 1922. (206,275.)
22,851. "Controlling system for electromagnetic transmission mechanism." C. E. F. Ahlm. August 22nd, 1922. (206,276.)
23,015. "Radio-telephonic and radio-telegraphic receiving and transmitting station." A. Perego. August 25th, 1921. (185,120.)
23,307. "Device for releasing billiard balls or the like and for automatically controlling lighting or other circuits." J. R. Bell and Burroughes & Watts, Ltd. August 28th, 1922. (206,282.)
25,473. "Sound amplifier for talking machines." W. H. Newcombe. September 20th, 1922. (206,305.)
26,292. "Sparking plugs." Sphinx Manufacturing Co., Ltd., and D. H. Corbin. September 29th, 1922. (206,319.)
29,267. "Electric ignition apparatus for internal-combustion engines." F. H. Royce and Rolls-Royce, Ltd. October 26th, 1922. (206,348.)
29,431. "Radio-receiving systems." British Thomson-Houston Co., Ltd. October 28th, 1921. (187,986.)
30,368. "Sparking plugs." R. Bosch Akt. Ges. August 28th, 1922. (202,942.)
30,667. "Variable electrical condensers." G. E. Barrington. November 9th, 1922. (206,365.)
30,790. "Lightning arresters." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). November 16th, 1922. (206,366.)
31,710. "Mercury watt-hour meter." Compagnie pour la Fabrication Des Compteurs et Matériel d'Usines A. Gaz. December 3rd, 1921. (189,773.)
31,931. "Sparking plugs." A. W. Bodin. November 22nd, 1922. (206,376.)
32,885. "Protection of electric machines and the like against overloading." British Thomson-Houston Co., Ltd.(Compagnie Française Thomson-Houston). December 1st, 1922. (206,386.)
34,176. "Thermionic valve amplifying systems." British Thomson-Houston Co., Ltd. December 14th, 1921. (190,489.)
34,702. "Electrically-illuminated hanging-box signs." A. H. Brackenbury and Franco-British Electrical Co., Ltd. December 20th, 1922. (206,396.)

1923.

1,043. "Sparking plugs." W. Bryson (J. Maaten). January 11th, 1923. (206,405.)
1,585. "Renewable electric fuses." British Thomson-Houston Co., Ltd. (Compagnie Française pour l'Exploitation des Procédés Thomson-Houston). January 17th, 1923. (206,410.)
1,965. "Electrical heater resistance elements." R. W. Reynolds. January 22nd, 1923. (206,412.)
3,414. "Lightning arresters." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). February 5th, 1923. (206,423.)
4,104. "Manufacture of small glow lamps." Naamlooze Vennootschap Pope's Metaaldraadlampenfabriek. March 8th, 1922. (194,673.)
7,654. "Medical apparatus for ultra-violet ray treatment." E. Steinberg. March 16th, 1923. (206,442.)
7,866. "Methods of, and apparatus for starting alternating-current motors." British Thomson-Houston Co., Ltd. (General Electric Co.). March 19th, 1923. (206,443.)
9,112. "Electrically-propelled vehicles." Soc. Anon. des Ateliers de Secheron. March 15th, 1922. (195,623.)
12,618. "Electrical apparatus for the projection of luminous advertisements and the like." H. L. Vacaresse. May 10th, 1922. (197,666.)
14,749. "Control systems for electrical distribution systems." Metropolitan-Vickers Electrical Co., Ltd. June 5th, 1922. (198,699.)
14,820. "Switching devices for automatic telephone systems." Coventry Automatic Telephones, Ltd. (A. H. Adams). June 6th, 1923. (206,454.)
17,231. "Anode casings for mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. July 12th, 1922. (200,808.)